

TSGENCO

4X270MW BHADRADRI TPS, TELANGANA

VOLUME -IIB

**TECHNICAL SPECIFICATION
FOR
MISCELLANEOUS PUMPS**

Specification No. : PE-TS-411-100-N001 (REV. 0)



**BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
PPEI BUILDING, SECTOR 16 A
NOIDA - 201301**

	PREAMBLE	SPECIFICATION NO.:	PE-TS-411-100-N001		
		REV. NO.	0	DATE:	31.07.15
1.0 The tender document contains three (3) volumes. The bidder shall meet the requirements of all the three volumes. 1.1 Volume I - CONDITIONS OF CONTRACT This consists of four parts as below: Volume - I A : This part contains instructions to bidders for making bids to BHEL. Volume - I B : This part contains general commercial conditions of the tender and include provision that vendor shall be responsible for the quality of item supplied by their sub-vendors. Volume - I C : This part contains special conditions of contract. Volume - I D : This part contains commercial conditions for erection and commissioning site work, as applicable. 1.2 Volume II - TECHNICAL SPECIFICATIONS Technical requirements are stipulated in Volume II which comprises of: Volume - II A : General Technical Conditions Volume - II B : Technical specification including drawings, if any 1.2.1 Volume - II B : This volume is sub-divided into following sections: Section - A : This section outlines the scope of enquiry. Section - B : This section provides "Project Information" Section - C : This section indicates technical requirements specific to the contract, not covered in Section-D. Section - D : This section comprises of technical specifications of equipments complete with data sheet A, B & C. Data sheet - A specifies data and other requirements pertaining to the equipment. Data sheet - B specifies data to be filled by the bidder (Data Sheet B is contained in Volume - III) Data sheet - C indicates data documents to be furnished after the award of contract as per agreed schedule by the vendor (as applicable). 1.2.2 Volume - III TECHNICAL SCHEDULES This volume contains technical schedules and Data Sheets - B, which are to be duly filled by the bidder and the same shall be furnished with the technical bid as per checklist, sec B7 in vol III. 2.0 The requirements mentioned in Section C/Data Sheets-A of Section-D shall prevail and govern in case of conflict between the same and the corresponding requirements mentioned in the descriptive portion in Section - D.					

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TECHNICAL SPECIFICATIONS

SPECIFICATION
NO.:

PE-TS-411-100-N001

MISCELLANEOUS PUMPS

VOLUME:

IIB

SECTION:

A

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SECTION A

SCOPE OF ENQUIRY

	TECHNICAL SPECIFICATIONS MISCELLANEOUS PUMPS SCOPE OF ENQUIRY	SPECIFICATION NO.:	PE-TS-411-100-N001		
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1.0 SCOPE

- 1.1 This enquiry covers the design, manufacture, assembly, inspection and testing at manufacturer's and/or his sub-contractors works, proper packing for delivery and installation checks and replacement of gland packing with Mechanical Seal arrangement (if applicable) at site for Miscellaneous Pumps along with mandatory spares complete with all accessories as per the requirements specified in this specification.:

4X270 MW BHADRADRI TPS, TELANGANA

The above project is referred as '4X270 MW BHADRADRI TPS' elsewhere in the Specification for ease of reference.

- 1.2 The miscellaneous pumps covered under this specification shall be Horizontal Pumps (Group-I) & Vertical Pumps (Group-II).

NOTE:-

- a) **The bidder shall include complete supplies for the Project/Group as above in his scope as per NIT. Part supplies offered for the Project/Group shall disqualify the bidder's offer for that Project/Group.**

- 1.3 The pumps erected by the purchaser shall be checked by the bidder for correctness of their installation, alignment, etc. at site prior to their commissioning. Replacement of gland packing with Mechanical Seal (If applicable) as per Cl. No. 2.0 of Section C1 & Cl. No. 9.08.04 of section D of this volume. The charges for these shall be included by bidder in his offer.
- 1.4 The miscellaneous pumps and drives covered under this specification for various projects are as per Annexure I. HT drives, wherever applicable and irrespective of motor ratings, shall be issued free of cost by BHEL. The details of pumps with HT drives shall be as per Annexure II.
- The Capacity, Head, Materials of construction, Mandatory spares and other particulars of these pumps, are detailed in Data Sheet-A annexed with Section-D of the specification.
- 1.5 For detailed scope of supply & services refer clause 3.00.00 of Standard technical Specification for Horizontal Centrifugal pumps & Vertical Pumps specified under Section-D of this volume.
- 1.6 Electrical scope between BHEL and Vendor for Miscellaneous pumps and drives of this specification shall be as per annexure I of section C-2 of this volume.

2.0 GENERAL TECHNICAL INSTRUCTIONS

- 2.1 It is not the intent to specify herein all the details of design and manufacture. However, the equipment shall conform in all respects to high standards of design, engineering and workmanship, and shall be capable of performing the required duties in a manner acceptable to Engineer/Owner who will interpret the meaning of drawings and specifications and shall be entitled to reject any component or material, which in his judgement is not in full accordance herewith.
- 2.2 The omission of specific reference to any component/accessory necessary for the proper performance of Miscellaneous Pumps and drives shall not relieve the bidder of the responsibility of providing such facilities to complete the supply of equipment at quoted prices.
- 2.3 BHEL's / Customer's representative shall be given full access to the shop in which the equipments are being manufactured or tested and all test records shall be made available to him.



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- 2.4 The equipments covered under this specification shall not be despatched unless the same have been finally inspected, accepted and shipping release issued by BHEL/Customer.
- 2.5 ***In case of any deviation from this technical specification (Vol.IIB) and General Technical Conditions (Vol.II A), the same shall be indicated in the schedule of deviations enclosed in Vol.III. In the absence of duly filled schedules it will be assumed that the bid strictly conforms to the specification.***
- 2.6 Unpriced copy of the price bid shall be furnished alongwith the technical bid.

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Annexure I

List of Miscellaneous Pumps and drives for :

A. 4X270 MW BHADRADRI TPS

Sl. No.	Pump Description	Total Qty.	Type of Pumps
	Horizontal Pumps (Group I)		
1	DMCW PUMPS	12 nos.	Horizontal
2	DMCW BOOSTER PUMPS	8 nos.	Horizontal
3	HOTWELL MAKE UP PUMPS	5 nos.	Horizontal
4	DM TRANSFER PUMPS	2 nos.	Horizontal
5	BOILER FILL PUMPS	2 nos.	Horizontal

Sl. No.	Pump Description	Total Qty.	Type of Pumps
	Vertical Pumps (Group II)		
1	RAW WATER PUMPS	3 nos.	Vertical
2	ACW PUMPS	12 nos.	Vertical
3	CW MAKE-UP PUMPS	3 nos.	Vertical
4	SERVICE WATER PUMPS	3 nos.	Vertical
5	APH/ESP WATER WASHING PUMPS	2 nos.	Vertical
6	POTABLE WATER PUMPS	2 nos.	Vertical

**TECHNICAL SPECIFICATIONS**

MISCELLANEOUS PUMPS
SCOPE OF ENQUIRY

SPECIFICATION
NO.:

PE-TS-411-100-N001

VOLUME:

IIB

SECTION:

A

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Annexure II

Following HT drives for 4X270 MW BHADRADRI TPS, irrespective of Motor ratings shall be issue free, by BHEL:

Horizontal Pumps (Group I):

- 1 DMCW PUMPS

Vertical Pumps (Group II):

- 1 RAW WATER PUMPS
- 2 ACW PUMPS

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SECTION B

PROJECT INFORMATION



PROJECT INFORMATION
FOR
4 X 270 MW BHADRADRI TPS

SPECIFICATION NO.

VOLUME II - B

SECTION - B

REV 00

DATE MAR 2015

PROJECT INFORMATION

INTRODUCTION

4x270 MW Bhadradi TPS is being set up by Telangana State Electricity Corporation Limited (TSGENCO) at Manuguru in the district of Khammam, Telangana, India.

The Bidder shall acquaint himself by a visit to the site, if felt necessary, with the conditions prevailing at site before submission of the bid. The information given here in under is for general guidance and shall not be contractually binding on BHEL/Owner. All relevant site data /information as may be necessary shall have to be obtained /collected by the Bidder.

APPROACH TO SITE

The distance from Manuguru to Major cities in state:

City	Km
Hyderabad	345
Warangal	180
Bhadrachalam	38
Kothagudem	70
Khammam	130
Vijayawada	195

District: KHAMMAM

State : TELANGANA

Nearest Airport: The nearest airport is Vijayawada Airport but the most used airport is the Hyderabad International Airport.

Nearest Railway Station: Manuguru railway station is 10KM from nearby town. However Warangal/Vijaywada railway Station is major railway station near to Manuguru.



PROJECT INFORMATION
FOR
4 X 270 MW BHADRADRI TPS

SPECIFICATION NO.

VOLUME II - B

SECTION - B

REV 00

DATE MAR 2015

1. Owner : TSGENCO
2. Project Title : 4X270 MW Bhadradi TPS
3. Location : 16 Km from Manuguru Railway station
4. Nearest Railway Stn. : Manuguru
5. Temperature
 - a. Mean daily minimum ambient temperature during oldest month of the year: 11.5 Deg.C
 - b. Mean daily minimum ambient temperature during hottest month of the year: 45.1 Deg.C
6. Rainfall: Intensity of rainfall @ 50 mm/hr considering heaviest fall in 24 hrs
7. Wind Data: Basic wind speed at 10m height : 44 m/sec
8. Wind pressure As per IS: 875 Part III- 1987
9. Seismic Zone: Zone III as defined in IS:1893 (part-1)-2002 according to Indian Standard Seismic Zoning Map

10	Power Supply : The power supplies for distribution and auxiliaries shall be as under:	
	a) In plant generation	16.5kV $\pm 5\%$, 3ph, 50Hz $\pm 5\%$, high resistance earthed.
	b) MV distribution	6.6kV $\pm 6\%$, 3ph, 3w , 50 Hz, + 5 % to – 5%, Non-effectively earthed
	c) LT distribution	415V $\pm 10\%$, 3ph, 4W, 50Hz + 5% to –5%, Effectively earthed
	d) Motor rated above 160kW	6.6kV $\pm 6\%$, 3 ph 50Hz +5% to -5%.
	e) Motor rated 160kW and below all motorized actuators.	415V $\pm 10\%$, 3 ph, 50Hz +5% to -5%.
	f) For motors equal and below 30kW winding heating	24V AC $\pm 10\%$, 50 Hz %, [to be generated in 415V switchgear by vendor]
	g) DC Motors	220V DC + 10% to - 15%, 2 wire ungrounded system
	h) Control supply for relay panel/ 6.6kV breakers/415V breakers and DC emergency lighting.	220V DC + 10% to - 15%, 2 wire ungrounded system
	i) UPS for instrumentation & Control system	240V AC $\pm 1\%$, 1 ph ,50Hz $\pm 0.5\%$ 2 Wire AC system
	j) Control supply for 415V Motor contactors/AC Control circuits [to be generated in MCC /panel by vendor]	110V AC $\pm 10\%$, 50Hz + 5% to –5%.
	k) Diesel Generator emergency supply	415V $\pm 10\%$, 3ph,3W, 50Hz +5%to –5%.
11	Fault levels	
	a) 400kV	40kA rms for 1 sec
	b) 6.6kV	40 kA rms for 1 sec.
	c) 415V	50 kA rms for 1 sec.
	d) DC Supply	25 kA



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SECTION C

SPECIFIC TECHNICAL REQUIREMENTS

C1: SPECIFIC TECHNICAL REQUIREMENTS FOR PUMPS

C2: SPECIFIC TECHNICAL REQUIREMENTS FOR MOTORS

C3: SPECIFIC TECHNICAL REQUIREMENTS FOR C&I INSTRUMENTS

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SECTION C1

SPECIFIC TECHNICAL REQUIREMENTS FOR PUMPS

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1.0

SPECIFIC TECHNICAL REQUIREMENTS:

DELIVERY:

Delivery of miscellaneous pumps shall be as per NIT requirement.

2.0

Horizontal Pumps:

2.1

Horizontal Pumps with Mechanical seal shall be supplied with gland packing arrangement to site and gland packing arrangement shall be replaced by vendor with mechanical seal arrangement at site after commissioning of the pumps with gland packing. However Mechanical seal shall be despatched alongwith main supply for this purpose. Shaft sleeve and any other item required for satisfactory operation of Mechanical seal after replacement at site shall be provided by the pump supplier without any cost implication to BHEL.

3.0

Vertical Pumps:

3.1

All Vertical pump motors shall be designed/capable of withstanding max. run away speed during reverse flow.

3.2

There are no thrust block for countering pump thrust and pump base plate shall be adequately designed to take the unbalanced forces and moments.

3.3

Following provision shall be provided to prevent damage due to reverse rotation of the pump motor assembly for all Vertical Pumps:

a) Non-reversible ratchet mechanism

b) Necessary switch to detect reverse rotation will be provided to prevent motor switching 'ON' while rotating in reverse direction.

5.0

Additional Dispatch Requirements:

MDCC after final inspection shall be provided to vendor on the basis of following:-

5.1

List of items packed in each box with description & quantity.

5.2

Photograph of each box in open & closed condition.

5.3

Bidder to include handling instructions in engineering drg/doc and packing to be done in such a way to avoid damage of items in transit and long storage at site and same shall be approved in oncontract stage by BHEL/Customer

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SECTION C2 SPECIFIC TECHNICAL REQUIREMENTS FOR MOTORS					



TITLE :
ELECTRICAL EQUIPMENT SPECIFICATION
FOR
MISC PUMP
4X270 MW BHADRADRI TPS

SPECIFICATION NO.
VOLUME NO. : II-B
SECTION : C
REV NO. : 00 DATE : 27.07.2015
SHEET : 1 OF 3

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:

- a) Services and equipment as per “Electrical Scope between BHEL and Vendor”.
- b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge.
- c) Supply of mandatory spares as specified in the specifications of mechanical equipments.
- d) Electrical load requirement for MISC PUMPS
- e) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
- f) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer/BHEL approval without any commercial and delivery implications to BHEL
- g) Various drawings, data sheets as per required format, Quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial implication to BHEL.
- h) Motor shall meet minimum requirement of motor specification.
- i) Vendor to clearly indicate equipment locations and local routing lengths in their cable listing furnished to BHEL.
- j) Cable BOQ worked out based on routing of cable listing provided by the vendor for “ both end equipment in vendor’s scope”shall be binding to the vendor with +10 % margin to take care of slight variation in routing length & wastages.

2.0 EQUIPMENT & SERVICES TO BE PROVIDED BY PURCHASER FOR ELECTRICAL & TERMINAL POINTS:

Refer “Electrical Scope between BHEL and Vendor”.

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

3.1 The electrical specification without any deviation from the technical/quality assurance requirements stipulated shall be deemed to be complied by the bidder in case bidder furnishes the overall compliance of package technical specification in the form of compliance certificate/No deviation certificate.

3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc, is required during tender stage. Any such submission even if made, shall not be considered as part of offer.

4.0 List of enclosures :

- a) Electrical scope between BHEL & vendor (Annexure –I)

	TITLE : ELECTRICAL EQUIPMENT SPECIFICATION FOR MISC PUMP 4X270 MW BHADRADRI TPS	SPECIFICATION NO.
		VOLUME NO. : II-B
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b) Technical specification for motors. c) Datasheets & quality plan for motors. d) Electrical Load data format (Annexure –II) e) BHEL cable listing format (Annexure –III)		

STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGE: MISC. PUMP (Supply Package)

PROJECT: 4X270 MW BHADRADRI TPS

ANNEXURE-I

<u>S.NO</u>	<u>DETAILS</u>	<u>SCOPE SUPPLY</u>	<u>SCOPE E&C</u>	<u>REMARKS</u>
1	415 V MCC	BHEL	BHEL	240 V AC (supply feeder)/415 V AC (3 PHASE 4 WIRE) supply shall be provided by BHEL based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract. Any other voltage level (AC/DC) required will be derived by the vendor.
2	Local Push Button Station (for motors)	BHEL	BHEL	Located near the motors.
3	Power cables, control cables and screened control cables	BHEL	BHEL	Incoming cable from BHEL supplied MCC will be informed by BHEL. Screened control cable between DCS & field equipment will also be informed by BHEL. Vendor shall provide lugs & glands accordingly.
4	Cable trays, accessories & cable trays supporting system	BHEL	BHEL	
5	Cable glands and lugs for equipments supplied by Vendor	Vendor	BHEL	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty tinned copper lugs for power and control cables.
6	Conduit and conduit accessories for cabling between equipments supplied by vendor	BHEL	BHEL	
7	Equipment grounding & lightning protection	BHEL	BHEL	
8	Below grade grounding	BHEL	BHEL	
9	LT Motors with base plate and foundation hardware	Vendor	BHEL	Makes shall be subject to BHEL approval at contract stage.
10	Mandatory spares	Vendor	-	Vendor to quote as per specification.
11	Recommended O & M spares	Vendor	-	As per specification
12	Any other equipment/material/service required for completeness of system but not specified above (to ensure trouble free and efficient operation of the system).	Vendor	BHEL	
13	Electrical equipment GA drawing	Vendor	-	For necessary interface review.

NOTES:

1. Make of all electrical equipments/items supplied shall be reputed make & shall be subject to approval of BHEL after award of contract.
2. All QPs shall be subject to approval of BHEL after award of contract without any commercial implication.

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SECTION C3

SPECIFIC TECHNICAL REQUIREMENTS FOR C&I (INSTRUMENTATION)

4 X270 MW BHADRADRI TPS

Specifications of Reverse Rotation Monitoring System		
A)	Specifications for Indicator	
1	Service	Reverse Rotation Monitor
2	Speed Range	0 – 1500 RPM
3	Indicator Electronics	The Indicator will have cards like signal conditioner cards power supply cards, microprocessor cards using latest state of the art microcontroller technology and will be replaceable individually by the user at site.
4	Power Supply	240 V AC
5	Front Plate Indication	Digital Indication of the rotation speed, Digital Indication of Normal, Reverse and Power On
6	No. of Contacts	4 NO + 4 NC
7	Rating Contacts	5 Amps at 240 V AC 50 Hz
8	Outputs	4-20mA corresponding to the speed of the rotation range
9	Casing	Metallic Panel Mounting Type
10	Dimensions	Casing : 192 mm x 96 mm x 160 mm Cutout : 188 mm x 92 mm x 160 mm
	Vendor will provide a complete user and troubleshooting Manual of the indicator containing brief write up about the system features and working principle along with details of the cards	
B)	Specification for Probes	
1	No. of Probes	3 Nos. (For each Reverse Rotation Monitor)
2	Type of Probe	Non contact type probes which can sense the reverse rotation Within 30 degrees of motion
3	Probe dia	M 30 x 1.5 with optional accessories of mounting arrangements
4	Probe length	65 mm
5	Power Supply	Each Probe is powered from the remotely mounted indicator with +12V DC
6	Sensitivity of the Probes	The probes will be capable of sensing the shaft rotation in a gap of 2 or 8 mm
7	Extension Cable	Cable of 3 meters will be supplied with each probe for Connection of the probe with the local Junction Box
8	Junction Box	A local Junction Box suitable for installation in harsh coastal environment will be provided by vendor. The Junction will have terminals suitable for connection of the Cable from remotely mounted indicator and the cables from the Proximity Sensors. Necessary glands, sealing will be provided to prevent entry of insects, dust, ash, etc.
9	Probe Construction	The probe will be suitable for working in harsh coastal environment
10	Mounting of the Probe	The probe will be mounted suitably using locknuts suitable for the probe
11	Target hole / key projection	Pump supplier should provide hole / slot/ projection on the shaft for Proximeter sensing and size of the hole / projection should be informed to vendor

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SECTION D

STANDARD TECHNICAL SPECIFICATIONS

D1: STANDARD TECHNICAL SPECIFICATIONS FOR PUMPS

D2: STANDARD TECHNICAL SPECIFICATIONS FOR MOTORS

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SECTION D1

STANDARD TECHNICAL SPECIFICATIONS FOR HORIZONTAL PUMPS NO. PE TS-179-06

STANDARD TECHNICAL SPECIFICATIONS FOR VERTICAL PUMPS NO. PE TS-179-07

DATA SHEET A ALONGWITH LIST OF MANDATORY SPARES &
WATER ANALYSIS

DATA SHEET C

QUALITY PLAN

	TITLE: STANDARD TECHNICAL SPECIFICATION HORIZONTAL CENTRIFUGAL PUMPS	SPECIFICATION NO. PES-179-06	
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		SECTION: D	
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		SHEET 1 of 14	

1.00.00	GENERAL INFORMATION	
1.01.00	The general guidelines as illustrated in the subsequent clauses of this section shall be applicable for horizontal centrifugal pumps to be procured under the scope of this package.	
2.00.00	CODES AND STANDARDS	
2.01.00	In addition to the requirements spelt out elsewhere in the specification, the equipment to be provided under this section shall specifically conform to the following codes, standards, specifications and regulations, as applicable, including all the latest amendments subsequent to the year of publication as mentioned below.	
2.01.01	IS-1520/1980:	Horizontal Centrifugal pumps for clear, cold and fresh water.
2.01.02	IS-5120/1977:	Technical requirements for Rotodynamic special Purpose pumps.
2.01.03	IS-5639/1970:	Pumps for handling chemicals & corrosive liquids.
2.01.04	IS-5659/1970:	Pumps for process water.
2.01.05	IS-6536/1972:	Pumps for handling volatile liquids.
2.01.06	IS-9137/1978:	Code for acceptance tests for centrifugal, mixed flow and axial flow pumps- Class 'C'.
2.01.07	ISO 3555/1977: BS 5316/1977 Part 2	Acceptance test for centrifugal, mixed flow and axial flow pumps - Class 'B' tests.
2.01.08	ISO 2548/1973: BS 5316/1976 Part 1	- Do - Class 'C' tests.
2.01.09	API-610/1989:	Centrifugal pumps for general refinery services.
2.01.10	HIS	Hydraulic Institute Standards, USA
2.01.11	PTC 8.2/1965:	Power Test Codes - Centrifugal pumps.
2.01.12	ASTM-1-165-55	Standard Methods for Liquid Penetration Inspection.
2.02.00	In case of any contradiction with the above standards and annexure, the stipulations in the annexure shall prevail and shall be binding on the bidder.	

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3.00.00	SCOPE OF SUPPLY & SERVICES:
3.01.00	The miscellaneous pumps and drives scope shall be as specified in Data Sheet A /Section A.
3.02.00	The Capacity, Head, Materials of construction and other particulars of pumps are detailed in Data Sheet A of the specification.
3.03.00	Accessories: All the pumps under this specification shall be complete with following standard/special accessories.
3.03.01	Standard accessories: a) LT Electric drives/motors (as applicable) with cable gland and lugs at motor end. (The bare HT drive motors and LT motors not in bidder's scope of supply, wherever required supplied as free issue by BHEL refer Cl. 5.08.00). b) Pump motor coupling along with coupling guard. c) Common base plate for pumps and motor. d) Self contained lubrication system along with all internal piping, valves, fittings, specialties etc. as required. e) Counter flanges for suction/ discharge nozzles along with fixing nuts, bolts and gaskets. f) Anchor bolts, nuts, seating steel works, shims etc. as necessary for mounting the pump-motor unit on Civil foundations. g) Suitable vent (with valves)/ lifting/ handling attachments for the pump/ motor/ accessories. h) Suitable drain connections with isolating valves as applicable. i) Supply of first fill of lubricants with topping requirements for one year of operation after commissioning and handing over of equipment. j) Set of "Special" Tools & Tackles for Pumps and motors, if any. k) Erection and commissioning spares, "on as required" basis. l) Bidder shall provide various drawings, data, calculations, test reports/ certificates, operation and maintenance manuals, As-built drawings, etc. as specified and as necessary.

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m) Mandatory spares as specified in respective Data Sheet-A of this section.

3.04.00 Services included in Bidder's Scope:

3.04.01 The pumps shall be guaranteed to meet the performance requirements specified vide Data Sheet -A and also for trouble free operation after commissioning. Schedule of performance guarantees (enclosed in Volume-III) duly filled and signed shall be furnished with the bid.

3.04.02 Pumps with Mechanical seal shall be supplied with gland packing arrangement initially to site and gland packing arrangement shall be replaced by vendor with mechanical seal arrangement at site after commissioning of the pumps with gland packing. However Mechanical seal shall be dispatched along with main supply for this purpose.

3.04.03 The pumps erected by the purchaser shall be checked by the bidder for correctness of their installation, alignment, etc. at site prior to their commissioning.

3.04.04 After commissioning of pumps at site, site performance test for Noise, vibration and parallel running of pumps of all pumps for each unit/project will be conducted by BHEL at project site to ensure that the pumps meet the specified requirements. In case of any deficiency, the vendor shall rectify the same at site at no additional cost to BHEL.

3.04.05 Performance Guarantees for pumps shall stand valid till the satisfactory completion of performance testing by BHEL and its acceptance by purchaser / customer.

3.05.00 Works excluded from Bidder's Scope:

a) All HT motors and those LT Motors which are specifically excluded.

b) Civil foundation

c) Suction/ discharge pipe works

d) MCC/ Switchgear/Power supply

e) Power and Control Cables, unless specifically specified in Electrical/ Systems portion of the specification.

f) Erection of equipments.

4.00.00 **BID EVALUATION CRITERIA & LIQUIDATED DAMAGES FOR SHORTFALL:**

4.01.00 The bids received shall be evaluated for power consumption at inlet to the motors, in respect of pumps specified in Data Sheet-A (working pump only viz. not the standby), for the purpose of price comparisons as briefed below:

The bid evaluation shall be done at the rate as specified in Data Sheet A per one (1) KW Power consumption, per working pump as follows.

KW = $\frac{Q \times H \times S}{P \times M \times 367.2}$

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Where Q = Rated capacity M³/hr
H = Rated TDH, MWC
P = Pump Efficiency
M = Motor Efficiency.
S = Specific Gravity of fluid handled

4.02.00 The efficiencies for pumps and motors for arriving at benchmark power for Bid Evaluation shall be as indicated in Data Sheet A for various pumps.

No advantage shall be given to the bidder for Aux. Power quoted lower than the Bench mark values calculated with KW calculation formula at Cl. 4.01.00 above, *considering the bid evaluation efficiencies for pump and motor as indicated in Data Sheet-A*. However the bids shall be evaluated as above if the Aux. Power quoted are higher than Bench mark values.

NOTE:
1. Efficiencies for HT motors and LT motors not in bidder's scope, for bid evaluation purpose shall be taken based on the maximum value as furnished in Data Sheet A.
2. During contract stage the Guaranteed power consumption of Pumps with BHEL supplied drives (HT/LT) for successful bidder shall be reworked by BHEL as below:

Revised guarantee power consumption shall be as per KW calculation formula at Cl. 4.01.00 above, *where P = pump efficiency guaranteed by bidder and M = motor efficiency as per approved datasheet of the supplied HT/LT motor*.

4.03.00 Liquidated damages for shortfall in Guaranteed KW

The above guaranteed power consumption shall be demonstrated by the successful bidder during performance testing at works/ site.

For pumps with BHEL supplied drives, the power consumption shall be compared with the reworked guarantee power consumption, defined as per note no. 2 of Cl. 4.02.00 above for the purpose of shortfall.

The liquated damages @ twice the bid evaluation rate as above per KW per working pump shall be levied in the event of failure of bidder to demonstrate the guaranteed power consumption.

5.00.00 **TECHNICAL REQUIREMENTS:**

5.01.00 The pumps shall meet the technical requirements of section “D” as well as Data Sheet - A. Wherever there is contradiction between Section D and Data Sheet-A, the latter shall prevail. In the event of any contradiction of section “D” with Section-C, the Section-C will prevail.

5.02.00 The pumps shall be Electric motor driven.

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5.03.00	The Pumps shall conform to HIS. It is bare minimum requirement, however, any other equivalent or stringent standard is also acceptable, if, all the requirements of HIS are also met.		
5.04.00	The horizontal pumps shall be Horizontal split casing type with speeds not exceeding 1500 RPM or as indicated in Data Sheet-A.		
5.05.00	No negative tolerance shall be permitted in rated capacity & TDH.		
5.06.00	No negative tolerance shall be permitted in efficiency at rated capacity.		
5.07.00	The shut off head of pumps shall be more than pump rated TDH and percentage variation may vary depending on the specific speed of the pump as under: i. 10-15% for pumps of specific speed up to 1000 US units, ii. 15-20% for pumps of specific speed in the range of 1000 to 2000 US units, iii. 20-40% for pumps of specific speed in the range of 2000 to 4000 US units, iv. Above 50% for pumps of specific speed in the range of 4000 to 7000 US units.		
5.08.00	All HT motors and those LT motors which are not in bidder's scope of supply : bare motors only, shall be supplied as free issue by BHEL through BHEL, based on ratings and TS (Torque - Speed) curve selected and furnished by the bidders along with their un-priced bid. The responsibility for satisfactory operation for combined performance of pumps & motors shall rest with the bidder only as if, the drive motors also have been supplied by the bidder. Couplings, base plate, foundation bolts, any other fittings, etc. as required shall be supplied by the bidders only. BHEL shall supply one number of each type of drive motors (where drive motor is not in bidder's scope of supply) for shop testing of pumps with job motors. All other motors shall be dispatched by BHEL directly to project sites.		
5.09.00	For all HT motor driven pumps, BHEL has envisaged vibration-monitoring system in their own scope. The bidder shall make provisions for mounting following on the pump/ pump shaft: • Purchaser's probes in both DE/NDE bearings of pumps • Key slots on pump shaft with dimensions as specified in Data Sheet A. • Other components as finalized during detailing. • For mounting of above on the HT motors, same shall be taken care by BHEL - Bhopal.		
5.10.00	The pumps shall be capable of developing the required total head at rated capacity for continuous operation. The pumps shall operate satisfactorily at any point on the Q-H characteristic curve over a range of 0% to 130% capacity and shall be suitable for continuous operation between 30% to 130% capacity.		

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5.11.00	Selection of the pumps shall be such that the design point shall be met even with negative manufacturing tolerance.		
5.12.00	The total head capacity curve shall be continuously rising towards the shut off, the pumps shall preferably be non-overloading type and stable.		
5.13.00	The pumps shall be capable of running over the entire range of NPSH conditions required without any noise, vibration or cavitations. The prevailing suction pressures for various pumps are indicated in Data Sheet-A for suitable mechanical design of pumps.		
5.14.00	The pumps shall be of stiff shaft design. The minimum internal clearances should be sufficiently more than the max. static deflection of the shaft. Shaft size selected must take into consideration the critical speed as specified in API-610.		
5.15.00	Pumps and motors shall run smooth without undue noise and vibration. The vibration shall be within vibration norms for testing as per American National Standard for 'Rotodynamics Pump' for Vibration Measurement and allowable values, Doc. ANSI/ HIS 9.6.4-2009. The applicable vibration limits for each pump, shall be indicated in the Technical Data sheet to be furnished by the successful bidder after award of LOI/ PO. The noise level shall be limited to 85 dB at distance of 1.0M.		
5.16.00	Pumps of a particular category shall be identical and shall be suitable for parallel operation with equal load division. Components of identical pumps shall be interchangeable.		
5.17.00	After installation, the guaranteed values of noise, vibration and parallel operation of pumps shall be tested and verified. If the site performance is found not meeting the requirements in any respect as specified, then the equipment shall be rectified or replaced by the vendor, at his own cost.		
5.18.00	High reliability of the pumps is an essential requirement and therefore it gets weightage over its efficiency. It is therefore essential that the bidder choose a standard proven model from the range of pumps manufactured.		
5.19.00	The offered pumps shall be of proven design meeting the experience-qualifying requirement of their operation at two sites for a minimum period of two years. Any deviation to this criterion shall be suitably highlighted in the deviations schedule.		
5.20.00	The bearings shall be self-water lubricated, no external water supply shall be available. The cooling/ lubrication water for bearings, etc. shall be tapped from the pump discharge and supplied thru' bidder's integral pipe work.		

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If water handled by pump is dirty/ not suitable for lubrication/ cooling, the bidder shall provide requisite strainer/ filters, tanks, motorized valves, etc. after the tap off for the required service, the arrangement provided shall be subject to Purchaser's approval.			
6.00.00	MANDATORY SPARES:		
6.01.00	Bidder to provide the Mandatory spares listed vide Data Sheet-A. Unit price of mandatory spares shall be furnished in price Schedule.		
6.02.00	Bidder shall include the cost of Mandatory Spares in the base price of the pump, unless specified otherwise in Sec-C of the specification or NIT.		
7.00.00	OTHER REQUIREMENTS:		
7.01.00	The quality of water handled by various pumps shall be as per Data Sheet-A.		
7.02.00	The materials of construction for various components specified are the minimum requirements and materials of construction for other components not specified shall be similarly selected by the bidder for the intended duty.		
7.03.00	The makes of various bought out items of bidder (i.e. motor, bearings, mechanical seal etc.) shall be subject to purchaser's approval in the event of order.		
7.04.00	Painting for Pumps		
	a) The surface of SS, Gun metal, brass, bronze and non-metallic component shall not be applied with any painting.		
	b) The Steel surface to be applied with painting shall be thoroughly cleaned before applying painting by brushing, shop blasting etc. as per the agreed procedure.		
	c) For all the steel surfaces inside the (indoor installation) building, a coat of red oxide primes of min. thickness DFT of 50 microns followed up with under coat of Synthetic Enamel paint of min. thickness DFT of 50 microns shall be applied. The top coat shall consist of two coats each of min. thickness DFT of 50 microns of synthetic enamel paint and thus total DFT shall be min. 200 microns.		
	d) For all the steel surfaces exposed to (outdoor installation) atmosphere, a coat of chlorinated rubber based zinc phosphate primer of min. thickness DFT of 50 microns followed up with under coat of chlorinated rubber paint of min. thickness DFT of 50 microns shall be applied. Then, intermediate coat consisting of one coat of chlorinated rubber based paint pigmented with Titanium di-oxide with min. thickness DFT of 50 microns and top coat shall consist of two coats each of min. thickness DFT of 50		

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microns of chlorinated rubber paint shall be provided. Total DFT of paint system shall be min. 200 microns.			
7.05.00	It is mandatory for the bidder to submit along with the bid, the deviations if any – whether major or minor in the schedule of deviations only. In the absence of deviations listed in the “Schedule of deviations, the offer shall be deemed to be full conformity with the specification, “not-withstanding” anything else stated elsewhere in bidder’s offer. The implied/indirect deviations shall not be binding on the purchaser.		
8.00.00	PERFORMANCE REQUIREMENTS		
8.01.00	Performance requirements for the pumps shall be as guided in Data sheet - A enclosed with this section.		
8.02.00	Pump(s) shall preferably be designed to have the best efficiency at flow within ± 10% of the specified duty point flow. The pumps shall be suitable for continuous operation at any point within the “Range of Operation” as stipulated in the Data Sheet - A attached with this section.		
8.03.00	Pump(s) shall preferably have a continuously rising head-capacity characteristics from the specified duty point towards shut-off point, the maximum being at shut-off to enable parallel operation. Under all circumstances, the ‘range of operation’ of the pumps shall exclude any unstable operating zone of the head-capacity curve.		
8.04.00	Wherever specified in the Data Sheet - A attached to this section, pumps of each category shall be suitable for parallel operation. The head vs. capacity, the BHP vs. capacity characteristics etc. shall be identical to ensure equal load sharing and trouble-free operation of any pump when the other pump(s) working in parallel with it trip.		
8.05.00	The pump set along with drive motor shall run smooth without undue noise and vibration. Acceptable vibration limits shall be guided by the HIS of USA. Refer clause 5.15.00 above for permissible limits.		
9.00.00	DESIGN AND CONSTRUCTION		
9.01.00	Pump Casing		
9.01.01	Pump casing shall be provided with adequate number of vents and priming connections with valves unless the pump is made self-venting and priming. Casing drain, as required, shall be provided complete with drain valves. It shall be provided with a connection for suction and discharge pressure gauge as standard feature.		
9.01.02	Pump design must ensure that the nozzles are capable of withstanding external reactions not less than those specified in API-610.		

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9.01.03	In case where an expansion joint is located at pump discharge, the pump assembly will be subjected to an additional thrust which will be transmitted to the foundation. This additional thrust shall be taken into the consideration of pump design.		
9.02.00	Impeller		
9.02.01	The Impeller assembly shall be dynamically balanced and designed with critical speed substantially above the operating speed.		
9.03.00	Wearing Rings		
9.03.01	Replaceable type wearing rings shall be furnished to prevent damage to impeller and casing.		
9.04.00	Shaft		
9.04.01	Shaft size shall be selected considering that the critical speed shall be away from the operating speed as recommended in applicable Code/Standard. The critical speed shall be at least 30% higher than the rated speed.		
9.05.00	Shaft Sleeves		
9.05.01	Renewable type fine finished shaft sleeves shall be provided at the stuffing boxes/mechanical seals. Length of the shaft sleeves must extend beyond the other faces of gland packing or seal end plate so as to distinguish between the leakage past Shaft and shaft sleeve and that past the seals/glands.		
9.05.02	Shaft sleeves shall be properly fastened to the shaft to prevent any leakage or loosening. Shaft sleeve assembly should ensure concentric rotation.		
9.06.00	Bearings		
9.06.01	Bearings shall be easily accessible without disturbing the pump assembly. A drain shall be provided at the bottom of each bearing housing.		
9.06.02	Heavy-duty sleeve/ball/roller type bearings shall be provided to take care of the radial loads.		
9.06.03	In case of sleeve type radial, axial thrust shall be absorbed in suitable hydraulic devices and/or thrust bearings.		
9.06.04	Bearings and hydraulic devices (if provided for balancing axial thrust) shall be of adequate design for taking the entire pump load arising from all probable conditions of continuous operation. Life of the bearings shall be guided by the design standard of the pump. Antifriction bearings of standard type, if provided, shall be selected for a minimum		

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	life 20,000 hrs. of continuous operation at maximum axial and radial loads at rated speed. Thrust bearing shall be capable of running continuously at maximum load.		
9.06.05	The bearing shall be oil/grease lubricated. Suitable lubricating arrangement for the bearings shall be furnished with the pump complete with all accessories like pump, filters, piping, fittings, valves, interlocking and supervising instruments etc. as necessary. The design shall be such that the bearing lubricant does not contaminate the liquid being pumped.		
9.06.06	Bearings of reputed makes are to be provided, same shall be indicated in Technical Data sheet to be furnished by the successful bidder after award of LOI/ PO, subject to acceptance of BHEL/ end customer, without any price implication to BHEL.		
9.07.00	Stuffing Boxes		
9.07.01	Stuffing box design shall permit replacement of packing without removing any part other than the gland.		
9.07.02	Stuffing boxes shall be sealed/cooled by the fluid being pumped/external clear water, as specified in the Annexure. All necessary pumps, piping, fittings, valves, instruments etc. as required for safe and trouble-free operation of the pumps and as specified in the Annexure shall be included in the scope of supply.		
9.08.00	Mechanical Seals		
9.08.01	Mechanical seals (cartridge type) shall be provided if specified in the Data Sheet-A of this section. The pump supplier shall co-ordinate with the seal maker in establishing the direct circulation rate for maintaining a stable film at the seal in the chamber. The seal piping system shall form an integral part of the pump assembly.		
9.08.02	When handling liquids near boiling point, suitable arrangement for external cooling shall be provided so as to prevent flashing at the seal faces.		
9.08.03	For the seals under vacuum service, the seal design must ensure sealing against atmospheric pressure, even when the pumps are not operating.		
9.08.04	Pumps with Mechanical seal shall be supplied with gland packing arrangement initially to site and gland packing arrangement shall be replaced by vendor with mechanical seal arrangement at site after commissioning of the pumps with gland packing. However Mechanical seal shall be dispatched along with main supply for this purpose. The special tools (if any) required for above shall be arranged by bidder.		
9.08.05	Mechanical seals of reputed makes are to be provided, same shall be indicated in Technical Data sheet to be furnished by the successful bidder after award of LOI/ PO, subject to acceptance of BHEL/ end customer, without any price implication to BHEL.		
9.09.00	Drive Unit		

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9.09.01	The pumps shall be driven by electric motor directly coupled as specified in the Data Sheet-A of this section. A heavy duty coupling along with coupling guard shall be provided between the pump and drive unit.		
9.09.02	Unless otherwise specified in Data Sheet-A of this section, drive unit power rating shall be the maximum of the following requirements. a) 15% margin over the pump shaft input power at the rated duty point. b) 5% margin over the maximum pump shaft input power required within the ‘Range of Operation’. c) Pump shaft input power required considering the overloading of the pump assuming single pump operation in the event of tripping of one or more of the pumps operating in parallel.		
9.10.00	Coupling for pump & Motor Shaft		
9.10.01	The pump and motor shafts shall be connected with adequately sized flexible coupling of proven design with spacer to facilitate dismantling of the pump without disturbing the motor. Necessary coupling guard shall be provided.		
9.10.02	No. of coupling holes for joining coupling hubs shall be even in number and preferably in multiples of four.		
10.00.00	INSPECTION AND TESTING		
10.01.00	The Quality Plans enclosed in the specification are for bidder’s guidance only. The bidder shall comply with these and other minimum requirements specified in the specification and shall furnish his own quality plan in the event of order based on the guidance given as above, for approval by BHEL/Customer.		
10.02.00	The Bidder shall carry out the following specific tests inspections to ensure that the equipment furnished lies in strict conformance with the specification and also in accordance with applicable codes/standards and good engineering practice. a) Identification and Testing i) All materials used for pump construction shall be of tested quality. Material shall be tested as per the relevant standard and test certificates shall be made available to the Owner. ii) 100% PMI (Process Material Identification) inspection for material grade of pump casing, shaft and impeller shall be done by vendor & certification shall be submitted for review of BHEL. Further BHEL reserves the right to conduct		



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random & independent PMI inspection on pump casing, shaft and impeller to ascertain the grade of material during inspection at vendor works.

iii) Tests for each pump included under this section shall include but not be limited to the following:

- The entire surface of the impeller / casing / diffuser castings shall be subjected to Dye Penetration Test as per ASTM Specification no.:1-165-65.
- Shaft coupling & other active components shall be subjected to Dye Penetration and Ultrasonic Tests.
- Wearing rings, shaft sleeves shall be subjected to Dye Penetration Test.
- Fabricated components of pumps shall be subjected to Dye Penetration test on weld.
- Verification of material, witnessing of pouring, casting and inspection of finished fabricated/castings.
- Inspection of finished castings for impeller and verification of materials.
- Inspection of pump shaft and verification of material.
- Witnessing of NDT/review of NDT reports.
- Static balancing test for impeller and dynamic balancing of complete rotating parts as per ISO- 1940 to grade 6.3 or better.
- Complete Inspection of assembled pump.

b) Hydraulic Testing

The pump casing shall be hydrostatically tested at maximum of the following:

- i. 2 times the TDH (Total Dynamic Head) at rated capacity (or)
- ii. 1.5 times the shut-off pressure (or)
- iii. System Design pressure indicated in Data Sheet-A of this section.

The HT pressure shall be maintained for a period of not less than 30 minutes. During testing there should not be any pressure drop & leakage.

c) Performance Test at Shop

- i) Each pump shall have to be tested to determine the performance curves of the pumps. These tests are to be conducted in presence of Owner's representative as per the requirements of the Standards of Hydraulic Institute

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of USA (ASME-Power Test Code PTC 8.2/BS-599) or any other equivalent standard. ii) Performance tests are to be conducted to cover the entire range of operation of the pumps at rated speed. These shall be carried out to span 130% of rated capacity up to pump shut-off condition. A minimum of five combinations of head and capacity are to be achieved during testing to establish the performance curves, including the design capacity point, shut-off point and the two extremities of the range of operation as specified in the annexure. After completion of performance test, all pumps shall be stripped down for inspection of internals. iii) Tests shall be conducted with actual drive motors being furnished. iv) NPSH tests are to be conducted for each type at 3% head drop conditions, if specified in the pump approved QP. v) Mechanical run test shall be carried out on all pumps to determine the vibration levels, noise levels etc. This test shall be conducted at site also. However, test value at site shall be used for the acceptance of the equipment. 10.03.00 Inspection of Mandatory/ Recommended spares shall be in line with approved QP for main supply. 11.00.00 DRAWINGS/ DOCUMENTS DISTRIBUTION SCHEDULE 11.01.00 After award of LOI, the successful bidder shall submit drawings/documents as per Data Sheet-C. 11.02.00 The no. of drawings/documents to be submitted shall be as per Annexure to Data Sheet-C. 12.00.00 The various Sections-C's & D's along with Data Sheets attached in this specification together with the specification for Miscellaneous Pumps shall be complied with by the bidders. 13.00.00 Bidder to submit all drawing/ documents in soft as well as hard copy within 2 weeks from placement of LOI's in the event of order. Within one (1) week of receipt of BHEL comments a technical representative from Bidder's works shall come for meeting with BHEL along with revised documents to resolve all issues and incorporate all comments in the soft copy here only for further submission to customer. Further on receipt of customer's comments on the documents a technical representative from Bidder's works shall come for meeting with Customer to resolve all issues and incorporate all comments in the soft copy here only and further resubmission of same to			


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Customer. The representative shall be available here till Category-I approval of all the drawings and documents.

14.00.00 Guarantee for all pumps shall at least remain valid for 18 months from the Unit commissioning date or as specified in NIT.

15.00.00 The following documents only shall be furnished by the bidder with his offer:

- a) Compliance certificate duly signed and stamped (enclosed at Vol. III of specn.).
- b) GA drawings of pumps and motors with following: (shall be only for reference purpose, same shall not be reviewed/commented by purchaser at this stage and shall be subject to approval only during contract).
 - Civil static & dynamic loads.
 - Foundation details.
- c) Guarantee Schedule duly signed and stamped (enclosed at Vol. III of specn.).
- d) Technical deviation schedule (if reqd.) (enclosed at Vol. III of specn.).
- e) Data for drive Motor (HT/LT- which is not in bidder's scope of supply - as applicable): Load torque speed curves of the pumps, selected motor rating, rpm, GD² of driven equipment.

Apart from above no other Drgs./Docs./Data sheets etc. are required to be submitted at bid stage and even if furnished shall not be taken cognizance of.



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1.00.00 GENERAL INFORMATION

1.01.00 The general guidelines as illustrated in the subsequent clauses of this section shall be applicable for vertical pumps to be procured under the scope of this package.

2.00.00 CODES AND STANDARDS

2.01.00 In addition to the requirements spelt out elsewhere in the specification, the equipment to be provided under this section shall specifically conform to the following codes, standards, specifications and regulations, as applicable, including all the latest amendments subsequent to the year of publication as mentioned below.

- | | | |
|---------|--|--|
| 2.01.01 | IS-1710/1989: | Vertical Turbine Pumps for Clear, Cold and Fresh Water. |
| 2.01.02 | IS-5120/1977: | Technical requirements for Rotodynamic special Purpose pumps. |
| 2.01.03 | IS-5639/1970: | Pumps for handling chemicals & corrosive liquids. |
| 2.01.04 | IS-5659/1970: | Pumps for process water. |
| 2.01.05 | IS-6536/1972: | Pumps for handling volatile liquids. |
| 2.01.06 | IS-9137/1978: | Code for acceptance tests for centrifugal, mixed flow and axial flow pumps- Class 'C'. |
| 2.01.07 | BS 5316 | Acceptance tests for Centrifugal, mixed flow Part-I/1976 and axial flow pumps - Class 'C' Tests (ISO 2548/1973) |
| 2.01.08 | BS 5316 | Acceptance tests for Centrifugal, mixed flow Part-II/1977 and axial flow pumps - Class 'B' Tests (ISO 3555/1977) |
| 2.01.09 | ANSI B 73.2M 1984 | Vertical inline centrifugal pumps for chemical process |
| 2.01.10 | API-610/1989: | Centrifugal pumps for general refinery services. |
| 2.01.11 | HIS | Hydraulic Institute Standards, USA |
| 2.01.12 | PTC 8.2/1965: | Power Test Codes - Centrifugal pumps. |
| 2.01.13 | ASTM-1-165-55 | Standard Methods for Liquid Penetration Inspection. |
| 2.02.00 | In case of any contradiction with the above standards and annexure, the stipulations in the annexure shall prevail and shall be binding on the bidder. | |



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3.00.00 SCOPE OF SUPPLY & SERVICES:

3.01.00 The miscellaneous pumps and drives scope shall be as specified in Data Sheet A /Section A.

3.02.00 The Capacity, Head, Materials of construction and other particulars of pumps are detailed in Data Sheet-A of the specification.

3.03.00 Accessories:

All the pumps under this specification shall be complete with following standard/special accessories.

3.03.01 Standard accessories:

- a) LT Electric drives/motors (as applicable) with cable gland and lugs at motor end. (The bare HT drive motors and LT motors not in bidder's scope of supply, wherever required supplied as free issue by BHEL refer Cl. 5.08.00).
- b) Pump motor coupling along with coupling guard.
- c) Common base/sole plate for pumps and motor.
- d) Thrust block assembly (Thrust pads, attachments) for transferring the pump thrust to concrete thrust block (concrete thrust block in purchaser scope), as per clause 5.23.00.
- e) Thrust bearing temp. measurement devise to be provided.
- f) Self contained lubrication system along with all internal piping, valves, fittings, specialties etc. as required.
- g) Counter flanges for suction/ discharge nozzles along with fixing nuts, bolts and gaskets.
- h) Anchor bolts, nuts, seating steel works, shims etc. as necessary for mounting the pump-motor unit on Civil foundations.
- i) Suitable vent (with valves)/ lifting/ handling attachments for the pump/ motor/ accessories.
- j) Suitable drain connections with isolating valves as applicable.
- k) Supply of first fill of lubricants with toping requirements for one year of operation after commissioning and handing over of equipment.
- l) Set of "Special" Tools & Tackles for Pumps and motors, if any.

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m) Erection and commissioning spares, “on as required” basis.			
n) Bidder shall provide various drawings, data, calculations, test reports/ certificates, operation and maintenance manuals, As-built drawings, etc. as specified and as necessary.			
o) Mandatory spares as specified in respective Data Sheet-A of this section.			
3.04.00	Services included in Bidder’s Scope:		
3.04.01	The pumps shall be guaranteed to meet the performance requirements specified vide Data Sheet -A and also for trouble free operation after commissioning. Schedule of performance guarantees (enclosed in Volume-III) duly filled and signed shall be furnished with the bid.		
3.04.02	The pumps erected by the purchaser shall be checked by the bidder for correctness of their installation, alignment, etc. at site prior to their commissioning.		
3.04.03	After commissioning of pumps at site, site performance test for Noise, vibration and parallel running of pumps of all pumps for each unit/project will be conducted by BHEL at project site to ensure that the pumps meet the specified requirements. In case of any deficiency, the vendor shall rectify the same at site at no additional cost to BHEL.		
3.04.04	Performance Guarantees for pumps shall stand valid till the satisfactory completion of performance testing by BHEL and its acceptance by purchaser / customer.		
3.05.00	Works excluded from Bidder’s Scope:		
	a) All HT motors and those LT Motors which are specifically excluded		
	b) Civil foundation		
	c) Suction/ discharge pipe works		
	d) MCC/ Switchgear/Power supply		
	e) Power and Control Cables, unless specifically specified in Electrical/ Systems portion of the specification.		
	f) Erection of equipments.		
4.00.00	BID EVALUATION CRITERIA & LIQUIDATED DAMAGES FOR SHORTFALL:		
4.01.00	The bids received shall be evaluated for power consumption at inlet to the motors, in respect of pumps specified in Data Sheet-A (working pump only viz. not the standby), for the purpose of price comparisons as briefed below:		
	The bid evaluation shall be done at the rate as specified in Data Sheet A per one (1) KW Power consumption, per working pump as follows.		
	KW = $\frac{Q \times H \times S}{P \times M \times 367.2}$		



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Where Q = Rated capacity M³/hr
H = Rated TDH, MWC
P = Pump Efficiency
M = Motor Efficiency.
S = Specific Gravity of fluid handled

4.02.00 The efficiencies for pumps and motors for arriving at benchmark power for Bid Evaluation shall be as indicated in Data Sheet A for various pumps.

No advantage shall be given to the bidder for Aux. Power quoted lower than the Bench mark values calculated with KW calculation formula at Cl. 4.01.00 *above, considering the bid evaluation efficiencies for pump and motor as indicated in Data Sheet-A.* However the bids shall be evaluated as above if the Aux. Power quoted are higher than Bench mark values.

NOTE:

1. Efficiencies for HT motors and LT motors not in bidder's scope, for bid evaluation purpose shall be taken based on the maximum value as furnished in Data Sheet A.
2. During contract stage the Guaranteed power consumption of Pumps with BHEL supplied drives (HT/LT) for successful bidder shall be reworked by BHEL as below:

Revised guarantee power consumption shall be as per KW calculation formula at Cl. 4.01.00 *above, where P = pump efficiency guaranteed by bidder and M = motor efficiency as per approved datasheet of the supplied HT/LT motor.*

4.03.00 Liquidated damages for shortfall in Guaranteed KW

The above guaranteed power consumption shall be demonstrated by the successful bidder during performance testing at works/ site.

For pumps with BHEL supplied drives, the power consumption shall be compared with the reworked guarantee power consumption, defined as per note no. 2 of Cl. 4.02.00 above for the purpose of shortfall.

The liquated damages @ twice the bid evaluation rate as above per KW per working pump shall be levied in the event of failure of bidder to demonstrate the guaranteed power consumption.

5.00.00 TECHNICAL REQUIREMENTS:

5.01.00 The pumps shall meet the technical requirements of section "D" as well as Data Sheet - A. Wherever there is contradiction between Section D and Data Sheet-A, the latter shall prevail. In the event of any contradiction of section "D" with Section-C, the Section-C will prevail.

5.02.00 The pumps shall be Electric motor driven.



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- 5.03.00 The Pumps shall conform to HIS. It is bare minimum requirement, however, any other equivalent or stringent standard is also acceptable, if, all the requirements are also met.
- 5.04.00 The type of Vertical pumps shall be as follows (if specifically not indicated otherwise in Data Sheet-A) :
- Vertical turbine type pumps with 1500rpm. (if no. of stages ≤ 5) shall be preferred.
 - If stages of vertical turbine pumps are more than 5, then sump pump construction shall be preferred with 1500 rpm speeds.
- 5.05.00 No negative tolerance shall be permitted in rated capacity & TDH.
- 5.06.00 No negative tolerance shall be permitted in efficiency at rated capacity.
- 5.07.00 The shut off head of pumps shall be more than pump rated TDH and percentage variation may vary depending on the specific speed of the pump as under:
- 10-15% for pumps of specific speed up to 1000 US units,
 - 15-20% for pumps of specific speed in the range of 1000 to 2000 US units,
 - 20-40% for pumps of specific speed in the range of 2000 to 4000 US units,
 - Above 50% for pumps of specific speed in the range of 4000 to 7000 US units.
- 5.08.00 All HT motors and those LT motors which are not in bidder's scope of supply : bare motors only, shall be supplied as free issue by BHEL through BHEL, based on ratings and TS (Torque - Speed) curve selected and furnished by the bidders along with their un-priced bid. The responsibility for satisfactory operation for combined performance of pumps & motors shall rest with the bidder only as if, the drive motors also have been supplied by the bidder..
- Couplings, base plate, foundation bolts, any other fittings, etc. as required shall be supplied by the bidders only. BHEL shall supply one number of each type of drive motors (where drive motor is not in bidder's scope of supply) for shop testing of pumps with job motors. All other motors shall be dispatched by BHEL directly to project sites.
- 5.09.00 For all HT motor driven pumps, BHEL has envisaged vibration-monitoring system in their own scope. The bidder shall make provisions for mounting following on the pump/ pump shaft:
- Purchaser's probes in both DE/NDE bearings of pumps
 - Key slots on pump shaft with dimensions as specified in Data Sheet A.
 - Other components as finalized during detailing.
 - For mounting of above on the HT motors, same shall be taken care by BHEL - Bhopal.
- 5.10.00 The pumps shall be capable of developing the required total head at rated capacity for continuous operation. The pumps shall operate satisfactorily at any point on the Q-H characteristic curve over a range of 0% to 130% capacity and shall be suitable for continuous operation between 30% to 130% capacity.



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- 5.11.00 Selection of the pumps shall be such that the design point shall be met even with negative manufacturing tolerance.
- 5.12.00 The total head capacity curve shall be continuously rising towards the shut off, the pumps shall preferably be non-overloading type and stable.
- 5.13.00 The pumps shall be capable of running over the entire range of submergence/ NPSH requirement conditions required without any noise, vibration or cavitations.
- The prevailing suction pressures for various pumps are indicated in Data Sheet-A for suitable mechanical design of pumps.
- 5.14.00 The pumps shall be of stiff shaft design. The minimum internal clearances should be sufficiently more than the max. static deflection of the shaft. Shaft size selected must take into consideration the critical speed as specified in API-610.
- 5.15.00 Pumps and motors shall run smooth without undue noise and vibration.
- The vibration shall be within vibration norms for testing as per American National Standard for 'Rotodynamics Pump' for Vibration Measurement and allowable values, Doc. ANSI/ HIS 9.6.4-2009. The applicable vibration limits for each pump, shall be indicated in the Technical Data sheet to be furnished by the successful bidder after award of LOI/ PO.
- The noise level shall be limited to 85 dB at distance of 1.0M.
- 5.16.00 Pumps of a particular category shall be identical and shall be suitable for parallel operation with equal load division. Components of identical pumps shall be interchangeable.
- 5.17.00 After installation, the guaranteed values of noise, vibration and parallel operation of pumps shall be tested and verified. If the site performance is found not meeting the requirements in any respect as specified, then the equipment shall be rectified or replaced by the vendor, at his own cost.
- 5.18.00 High reliability of the pumps is an essential requirement and therefore it gets weightage over its efficiency. It is therefore essential that the bidder choose a standard proven model from the range of pumps manufactured.
- 5.19.00 The offered pumps shall be of proven design meeting the experience-qualifying requirement of their operation at two sites for a minimum period of two years. Any deviation to this criterion shall be suitably highlighted in the deviations schedule.
- 5.20.00 The bearings shall be self-water lubricated, no external water supply shall be available. The cooling/ lubrication water for bearings, etc. shall be tapped from the pump discharge and supplied thru' bidder's integral pipe work.

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5.21.00	If water handled by pump is sea water/ dirty/ not suitable for lubrication/ cooling:		
5.21.01	The bearing lubrication/cooling may be specifically reviewed by bidders for the suitability with water analysis enclosed with Data Sheet-A of this section. These pumps shall necessarily be provided with Thordan type line shaft bearings even if the other type of bearings are claimed suitable by the manufacturers. The bidder's shall satisfactorily establish the adequacy of self water lubrication if provided, for similar rating pumps installed for the duty condition in the event of order. In absence of adequate documentary evidence to the satisfaction level of BHEL, the bidder shall provide force water lubrication as per clause 5.21.02 below without any cost implication.		
5.21.02	In the event, the forced water lubrication is envisaged by the bidder, the following minimum requirements shall be complied with further details subject to Purchaser's approval during detailed engineering after the award of order. One set of common water lubrication system shall be provided separately for each type of pumps. The lubricating system shall provide continuous lubrication to all the pumps during operation and the minimum requirements shall be as follows: • 2X100 % duty self cleaning strainers of suitable size and mesh opening shall be installed on the common pump discharge and outlet shall be led to 1 no. 6 hrs. storage or min. 10 M3 capacity Sintex tank, to be placed on roof of pump house . • 2X100 % duty horizontal centrifugal lubricating pumps with TDH more than the shut off head of the subject pumps shall be provided. The capacity of each pump shall be sufficient to lubricate all of the subject pumps including 10% margin on capacity and head to suit requirement with 10 % margin with head. • These horizontal pumps shall take suction from the overhead Sintex tank as explained above. • Associated piping, fittings, Tank inlet motor operated valve, lubricating pumps suction & discharge isolating valves, motorised/ solenoid valves (as per purchaser's approval), lubricating pumps discharge check valves and lubricating pipe isolating valve at inlet to each of subject pump, etc. as required shall be provided.		



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- Instrumentation – Level Gauge, high level & low level switches for tank, pressure gauges at suction & discharge of each lubricating water pumps, low pressure switch on lubricating pipe at inlet to each of subject pump for subject pump start interlock, pressure switch on lubricating pipe at common discharge of subject pump for start up of stand by pump etc., as required subject to purchaser's approval shall be provided.
- Bidder shall supply any other equipment/ instrument required for proper functioning of the lubricating system, as deemed necessary during contract without any price implication to BHEL.
- Bidder shall also provide a relay based local control panel for proper functioning of the above system. The system shall be suitable for fully automatic operation as per approved write-up during detailed stage.
- Subject pumps shall be provided with shaft enclosing tube in the event above Lubrication system is envisaged by bidder. MOC for shaft enclosing tube shall be equivalent/ superior to MOC for column pipe for subject pump.

The complete forced water lubrication as above – if applicable, shall be in bidder's scope. Bidder to inform in schedule of deviation at bid submission stage, if fresh water is required for forced water lubrication system.

5.22.00 For Vertical pumps no thrust block is being provided except for pumps of projects, specified in Sec-C1 of this specification. Bidder to design the pump foundation system (base plate/ sole plate, discharge head, foundation bolts etc.) capable of transferring the pump thrust to the concrete pump foundation itself.

5.23.00 If specified in Sec-C1 of specification, thrust block assembly (Thrust pads, attachments) for transferring the pump thrust to concrete thrust block (concrete thrust block in purchaser scope) to be provided by bidder.

6.00.00 MANDATORY SPARES:

6.01.00 Bidder to provide the Mandatory spares listed vide Data Sheet-A. Unit price of mandatory spares shall be furnished in price Schedule.

6.02.00 Bidder shall include the cost of Mandatory Spares in the base price of the pump, unless specified otherwise in Sec-C of the specification or NIT.

7.00.00 OTHER REQUIREMENTS:

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7.01.00	The quality of water handled by various pumps shall be as per Data Sheet-A.		
7.02.00	The materials of construction for various components specified are the minimum requirements and materials of construction for other components not specified shall be similarly selected by the bidder for the intended duty.		
7.03.00	The makes of various bought out items of bidder (i.e. motor, bearings etc.) shall be subject to purchaser's approval in the event of order.		
7.04.00	Painting for Pumps		
	a) The surface of SS, Gun metal, brass, bronze and non-metallic component shall not be applied with any painting.		
	b) The Steel surface to be applied with painting shall be thoroughly cleaned before applying painting by brushing, shop blasting etc. as per the agreed procedure.		
	c) For all the steel surfaces inside the (indoor installation) building, a coat of red oxide primes of min. thickness DFT of 50 microns followed up with under coat of Synthetic Enamel paint of min. thickness DFT of 50 microns shall be applied. The top coat shall consist of two coats each of min. thickness DFT of 50 microns of synthetic enamel paint and thus total DFT shall be min. 200 microns.		
	d) For all the steel surfaces exposed to (outdoor installation) atmosphere, a coat of chlorinated rubber based zinc phosphate primer of min. thickness DFT of 50 microns followed up with under coat of chlorinated rubber paint of min. thickness DFT of 50 microns shall be applied. Then, intermediate coat consisting of one coat of chlorinated rubber based paint pigmented with Titanium di-oxide with min. thickness DFT of 50 microns and top coat shall consist of two coats each of min. thickness DFT of 50 microns of chlorinated rubber paint shall be provided. Total DFT of paint system shall be min. 200 microns.		
7.05.00	It is mandatory for the bidder to submit along with the bid, the deviations if any – whether major or minor in the schedule of deviations only. In the absence of deviations listed in the “Schedule of deviations, the offer shall be deemed to be full conformity with the specification, “not-withstanding” anything else stated elsewhere in bidder’s offer. The implied/indirect deviations shall not be binding on the purchaser.		
8.00.00	PERFORMANCE REQUIREMENTS		
8.01.00	Performance requirements for the pumps shall be as guided in Data sheet - A enclosed with this section.		

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8.02.00	Pump(s) shall preferably be designed to have the best efficiency at flow within ± 10% of the specified duty point flow. The pumps shall be suitable for continuous operation at any point within the “Range of Operation” as stipulated in the Data Sheet - A attached with this section.		
8.03.00	Pump(s) shall preferably have a continuously rising head-capacity characteristics from the specified duty point towards shut-off point, the maximum being at shut-off to enable parallel operation. Under all circumstances, the ‘range of operation’ of the pumps shall exclude any unstable operating zone of the head-capacity curve.		
8.04.00	Wherever specified in the Data Sheet - A attached to this section, pumps of each category shall be suitable for parallel operation. The head vs. capacity, the BHP vs. capacity characteristics etc. shall be identical to ensure equal load sharing and trouble-free operation of any pump when the other pump(s) working in parallel with it trip.		
8.05.00	The pump set along with drive motor shall run smooth without undue noise and vibration. Acceptable vibration limits shall be guided by the HIS of USA. Refer clause 5.15.00 above for permissible limits.		
9.00.00	DESIGN AND CONSTRUCTION Pumps shall be of vertical shaft, complete with bowl, column pipe, discharge head and base plate with all accessories. General design and constructional features of the pumps shall be as follows:		
9.01.00	Bowl Assembly		
9.01.01	This will be either a single or multi-stage centrifugal, mixed flow or axial flow type with discharge co-axial with shaft. Type of impeller shall be chosen on the basis of the pump specific speed and the characteristics of handling fluid.		
9.01.02	Pumps (s) shall have provision for adjustment of impellers in vertical direction from an accessible location, preferably at the housing (where separate thrust bearing for the pump is provided). The adjustment mechanism must take into consideration the extension of the line shaft due to hydraulic down thrust, weight of the shaft and impeller.		
9.02.00	Discharge Head		
9.02.01	Pump (s) shall have above/below floor discharge, as specified in the Data Sheet-A, attached to this section.		
9.03.00	Column pipe		
9.03.01	Column pipe shall be flanged and of bolted connection. Column pipes shall be designed		

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for full internal vacuum.			
9.03.02	In case of multi-piece column pipe and shaft assembly, the design shall permit raising/lowering of the pump assembly piece by piece without any difficulty. Any fixtures, clamps, etc. necessary for such purpose shall be supplied by the Bidder under this section.		
	The bidder shall also submit a write-up describing clearly the procedure of handling the pump.		
9.04.00	Impeller shaft, line shaft and head shaft		
9.04.01	Shaft size shall be selected on the basis of maximum torque to be applied on the pump shaft.		
	The critical speed shall be at least 30% higher than the rated speed.		
9.04.02	Impeller shaft shall be guided by bearings provided in each bowl or above and below the impeller shaft assembly. The butting faces of the shaft shall be machined square to the assembly and the shaft shall chamfered at the edges.		
9.04.03	Line shaft may be single or multiple pieces as required. In case of multiple pieces, line shaft shall be coupled as per the standard practice of the manufacture. For screwed coupling, directions shall permit tightening of the joint during pump operation.		
9.04.04	Replaceable shaft sleeves shall be furnished at applicable location, particularly under stuffing box and at other locations, as considered necessary.		
9.05.00	Shaft enclosing tube		
	Shaft enclosing tube shall be required, unless self lubricated (and cooled) type of shaft bearings are asked for. Length of the shaft enclosing tube shall be in conformity with the shaft piece lengths.		
9.06.00	Seal rings		
	Replaceable seal/wear rings both on impeller and on casing shall be provided in case it is asked for in this specification.		
9.07.00	Bearings		
9.07.01	Shaft bearings		
	Adequate number of properly designed bearings shall be provided for smooth and trouble free operation of the pump. Number of bearings shall consider the number of shaft pieces used and the critical speed of the shaft. Bearings shall be either lubricated by external clear water/oil/grease or self lubricated as specified in the Data Sheet-A of this section.		



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In case of external water/oil lubrication, complete lubrication arrangement shall be furnished with the pump. In case of forced water lubrication of the shaft bearings, the system and other accessories shall be in the scope of supply of Bidder as per clause 5.21.02.

9.07.02 Thrust Bearing

Thrust bearing of adequate size and capacity shall be provided to take the vertical thrust of the impeller arising out of the pump operation and dead weight of the rotating components. Life of the thrust bearing shall be guided by the design standard of the pump. Thrust bearing shall be capable of running continuously at maximum load.

Thrust bearing shall be either grease or oil lubricated. Lubrication arrangement shall be such that the lubricant does not contaminate the handling fluid. The arrangement shall also be adequate to protect the bearing, while the pump coast down to stop in case of power failure of the station. Pre-lubrication of the thrust bearing, if recommended by the pump manufacturer, shall be taken care of in designing the lubrication system.

Cooling of the thrust bearing, if necessary, shall be done by the handling fluid/external water, depending on the fluid handled.

Location of the thrust bearing may be at the pump body or at the driver, or at both depending on the requirement indicated in this specifications or as per the recommendation of the pump manufacturer (and approved by Purchaser).

9.07.03 Bearings of reputed makes are to be provided, same shall be indicated in Technical Data sheet to be furnished by the successful bidder after award of LOI/ PO, subject to acceptance of BHEL/ end customer, without any price implication to BHEL.

9.08.00 Reverse Rotation

9.08.01 If indicated at Section-C of the specification, the pump impeller and other rotating components shall be designed for reverse rotation, when subject to reverse flow at rated pump discharge head.

9.09.00 Drive Unit

9.09.01 The pumps shall be driven by electric motor directly coupled as specified in the Data Sheet-A of this section. A heavy duty coupling along with coupling guard shall be provided between the pump and drive unit.

9.09.02 Unless otherwise specified in Data Sheet-A of this section, drive unit power rating shall be the maximum of the following requirements.

- a) 15% margin over the pump shaft input power at the rated duty point.

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b) 5% margin over the maximum pump shaft input power required within the 'Range of Operation'. c) Pump shaft input power required considering the overloading of the pump assuming single pump operation in the event of tripping of one or more of the pumps operating in parallel.			
9.09.03	All Vertical pump motors shall be designed/capable of withstanding max. run away speed during reverse flow through pump.		
10.00.00	INSPECTION AND TESTING		
10.01.00	The Quality Plans enclosed in the specification are for bidder's guidance only. The bidder shall comply with these and other minimum requirements specified in the specification and shall furnish his own quality plan in the event of order based on the guidance given as above, for approval by BHEL/Customer.		
10.02.00	The Bidder shall carry out the following specific tests inspections to ensure that the equipment furnished lies in strict conformance with the specification and also in accordance with applicable codes/standards and good engineering practice.		
a) Identification and Testing i) All materials used for pump construction shall be of tested quality. Material shall be tested as per the relevant standard and test certificates shall be made available to the Owner. Material identification and testing shall include, but shall not be limited to the following components : • Bowls and suction bells • Impeller and wearing rings • Shafts and shaft sleeves • Couplings • Bearings • Column pipes • Discharge heads • Bowl Assembly ii) 100% PMI (Process Material Identification) inspection for material grade of pump casing, shaft and impeller shall be done by vendor & certification shall be submitted for review of BHEL. Further BHEL reserves the right to conduct random & independent PMI inspection on pump casing, shaft and impeller to ascertain the grade of material during inspection at vendor works. iii) Tests for each pump included under this section shall include but not be limited to the following:			



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- The entire surface of the impeller / casing / diffuser castings shall be subjected to Dye Penetration Test as per ASTM Specification no.:1-165-65.
- Shaft coupling & other active components shall be subjected to Dye Penetration and Ultrasonic Tests.
- Wearing rings, shaft sleeves shall be subjected to Dye Penetration Test.
- Fabricated components of pumps shall be subjected to Dye Penetration test on weld.
- Verification of material, witnessing of pouring, casting and inspection of finished fabricated/castings.
- Inspection of finished castings for impeller and verification of materials.
- Inspection of pump shaft and verification of material.
- Witnessing of NDT/review of NDT reports.
- Static balancing test for impeller and dynamic balancing of complete rotating parts as per ISO- 1940 to grade 6.3 or better.
- Complete Inspection of assembled pump.

b) Hydraulic Testing

Bowls/ Suction bells, Columns pipe, Discharge head & Any other applicable pressure parts shall be hydrostatically tested at maximum of the following:

- i. 2 times the TDH (Total Dynamic Head) at rated capacity (or)
- ii. 1.5 times the shut-off pressure
- iii. System Design pressure indicated in Data Sheet-A of this section.

The HT pressure shall be maintained for a period of not less than 30 minutes. During testing there should not be any pressure drop & leakage.

c) Performance Test at Shop

- i) Each pump shall have to be tested to determine the performance curves of the pumps. These tests are to be conducted in presence of Owner's representative as per the requirements of the Standards of Hydraulic Institute of USA (ASME-Power Test Code PTC 8.2/BS-599) or any other equivalent standard.
- ii) Performance tests are to be conducted to cover the entire range of operation of the pumps at rated speed. These shall be carried out to span 130% of rated

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capacity up to pump shut-off condition. A minimum of five combinations of head and capacity are to be achieved during testing to establish the performance curves, including the design capacity point, shut-off point and the two extremities of the range of operation as specified in the annexure. After completion of performance test, all pumps shall be stripped down for inspection of internals. iii) Tests shall be conducted with actual drive motors being furnished. iv) Minimum submergence/ NPSH required tests are to be conducted for each type at 3% head drop conditions, if specified in the pump approved QP. v) All rotating components of the pumps shall be subjected to static and dynamic balancing tests. The assembled rotor will be subjected to dynamic balancing tests. vi) Mechanical run test shall be carried out on all pumps to determine the vibration levels, noise levels etc. This test shall be conducted at site also. However, test value at site shall be used for the acceptance of the equipment. 10.03.00 Inspection of Mandatory/ Recommended spares shall be in line with approved QP for main supply. 11.00.00 DRAWINGS/ DOCUMENTS DISTRIBUTION SCHEDULE 11.01.00 After award of LOI, the successful bidder shall submit drawings/documents as per Data Sheet-C. 11.02.00 The no. of drawings/documents to be submitted shall be as per Annexure to Data Sheet-C. 12.00.00 The various Sections-C's & D's along with Data Sheets attached in this specification together with the specification for Miscellaneous Pumps shall be complied with by the bidders. 13.00.00 Bidder to submit all drawing/ documents in soft as well as hard copy within 2 weeks from placement of LOI's in the event of order. Within one (1) week of receipt of BHEL comments a technical representative from Bidder's works shall come for meeting with BHEL along with revised documents to resolve all issues and incorporate all comments in the soft copy here only for further submission to customer. Further on receipt of customer's comments on the documents a technical representative from Bidder's works shall come for meeting with Customer to resolve all issues and incorporate all comments in the soft copy here only and further resubmission of same to			



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Customer. The representative shall be available here till category I approval of all the drawings and documents.

14.00.00 Guarantee for all pumps shall at least remain valid for 18 months from the Unit commissioning date or as specified in NIT.

15.00.00 The following documents only shall be furnished by the bidder with his offer:

- a) Compliance certificate duly signed and stamped (enclosed at Vol. III of specn.).
- b) GA drawings of pumps and motors with following: (shall be only for reference purpose, same shall not be reviewed/commented by purchaser at this stage and shall be subject to approval only during contract).
 - Civil static & dynamic loads.
 - Foundation details.
 - Minimum Submergence required.
 - Clearances - Side, Back & Bottom
 - Min. Recommended crane capacity
- c) Guarantee Schedule duly signed and stamped (enclosed at Vol. III of specn.).
- d) Technical deviation schedule (if reqd.) (enclosed at Vol. III of specn.).
- e) Data for drive Motor (HT/LT- which is not in bidder's scope of supply - as applicable):
Load torque speed curves of the pumps, selected motor rating, rpm, GD^2 of driven equipment.

Apart from above no other Drgs./Docs./Data sheets etc. are required to be submitted at bid stage and even if furnished shall not be taken cognizance of.

	DATA SHEET - A				SPECIFICATION NO.:	PE-TS-411-100-N001
	MISCELLANEOUS PUMPS (HORIZONTAL) - GROUP-I				REV. NO.: 00	DATE : 30/07/2015
	4X270MW BHADRADRI TPS				VOLUME : II B	SECTION : D
Sl. No.	DESCRIPTION	DMCW PUMPS	DMCW BOOSTER PUMPS	HOTWELL MAKE-UP PUMPS	DM TRANSFER PUMPS	BOILER FILL PUMPS
1.0	SERVICE					
1.1	Total no. of pumps for Project	Total 12 nos. viz. 3 (three) nos. per unit	Total 8 nos. viz. 2 (three) nos. per unit	Total 5 nos.	Total 2 nos.	Total 2 nos.
1.2	No. of working & standby pumps	(2W+1S) per unit	(1W+1S) per unit	(4W+1S) for Station	(1W+1S) for Station	(1W+1S) for Station
1.3	Liquid Handled (ref. water analysis enclosed herein)	pH corrected DM Water	pH corrected DM Water	DM Water	DM Water	DM Water
1.4	Location (Indoor / Outdoor)	Indoor	Indoor	Indoor	Indoor	Indoor
1.5	Duty	Continuous	Continuous	Intermittent	Intermittent	Intermittent
1.6	No. of pumps working in parallel	2	-	-	-	-
1.7	Specific gravity	1	1	1	1	1
1.8	System design pressure (kg/sqcm), g	10	10	10	10	19
2.0	DESIGN PARAMETERS					
2.1	Design capacity each, M ³ /hr	1180	700	60	240	200
2.2	Total dynamic head (MWC)	45.5	12.5	60	60	150
2.3	Suction Pressure(MWC)	22	46	Flooded suction	Flooded suction	Flooded suction
2.4	Design Temperature (°C)	60	60	60	60	60
2.5	Maximum permissible speed of pump (RPM) (with Motor rpm fixed only for HT drives as 1500 rpm)	1500	1500	1500	1500	1500
2.6	Max. limit on shut off head Corresponding to pump TDH (MWC) at 51.5 Hz	Not to exceed 75 MWC	Not to exceed 45 MWC	Not to exceed 90 MWC	Not to exceed 90 MWC	Not to exceed 190 MWC
2.7	Operating range	-----30-130% of design duty point flow-----				
2.8	Motor rating	Drive Motor rating (including voltage and frequency variation), at an ambient temp. of 50 Deg C, shall be minimum 224KW (HT Motor in BHEL scope). The maximum of the following condition shall also be fulfilled while selecting the motor rating, viz. a) a margin of at least 15 % over the shaft requirement at the duty condition b) 10% margin over the maximum pump shaft input power required within the entire characterstic curve of the pump. c) Pump shaft input power required considering the overloading of the pump assuming single pump operation in the event of tripping of one or more of the pumps operating in parallel.				
2.9	Permissible tolerance in rated capacity & TDH	No negative tolerance				
2.10	Permissible tolerance in efficiency at rated capacity(%)	No negative tolerance				
2.11	Performance/Design Standard	HIS / IS 5120				
3.0	CONSTRUCTION FEATURES					
3.1	Pump type	Horizontal centrifugal type Between Bearing Pump	Horizontal centrifugal type Between Bearing Pump	Horizontal centrifugal type	Horizontal centrifugal type	Horizontal centrifugal type
3.2	Impeller type	Closed	Closed	Closed	Closed	Closed
3.3	Casing type	Horizontal axial split type	Horizontal axial split type	To be decided by Bidder	To be decided by Bidder	To be decided by Bidder
3.4	Coupling type	Flexible type	Flexible type	Flexible type	Flexible type	Flexible type



DATA SHEET - A					SPECIFICATION NO.:	PE-TS-411-100-N001
MISCELLANEOUS PUMPS (HORIZONTAL) - GROUP-I					REV. NO.: 00	DATE : 30/07/2015
4X270MW BHADRADRI TPS					VOLUME : II B	SECTION : D
Sl. No.	DESCRIPTION	DMCW PUMPS	DMCW BOOSTER PUMPS	HOTWELL MAKE-UP PUMPS	DM TRANSFER PUMPS	BOILER FILL PUMPS
3.5	Sealing arrangement	Gland packing initially & Mechanical seal finally after commissioning	Gland packing initially & Mechanical seal finally after commissioning	Gland packing initially & Mechanical seal finally after commissioning	Gland packing initially & Mechanical seal finally after commissioning	Gland packing initially & Mechanical seal finally after commissioning
3.6	Type of Lubrication	Self Liquid/Oil/Grease	Self Liquid/Oil/Grease	Self Liquid/Oil/Grease	Self Liquid/Oil/Grease	Self Liquid/Oil/Grease
3.7	Pump characteristics	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable
3.8	Drain Plugs, vent, lifting lugs, priming connection	Required				
4.0	MATERIALS OF CONSTRUCTION					
4.1	Casing	2 % Ni Cl to IS 210 FG 260	2 % Ni Cl to IS 210 FG 260	SS-316	SS-316	SS-316
4.2	Impeller	SS316/ SS ASTM – A351 – CF8M	SS316/ SS ASTM – A351 – CF8M	SS-316	SS-316	SS-316
4.3	Shaft	SS 410	SS 410	SS 410	SS 410	SS 410
4.4	Shaft Sleeves	SS 316	SS 316	SS 316	SS 316	SS 316
4.5	Impeller Wearing rings	SS 316	SS 410	SS-410	SS-410	SS-410
4.6	Bolts & Nuts	SS-316	SS-316	SS-316	SS 316	SS 316
4.7	Gland/Seal Cover	SS-316	SS-316	SS-316	SS-316	SS-316
4.8	Lantern Ring	SS-316	SS-316	SS-316	SS 316	SS 316
4.9	Mech. seal	Manufacturer standard	Manufacturer standard	Manufacturer standard	Manufacturer standard	Manufacturer standard
4.10	Gland Packing	Braided Impregnated Teflon (Asbestos Free)	Braided Impregnated Teflon (Asbestos Free)	Braided Impregnated Teflon (Asbestos Free)	Braided Impregnated Teflon (Asbestos Free)	Braided Impregnated Teflon (Asbestos Free)
4.11	Base Plate	MS fabricated IS-2062 (min. thk.-10 mm) Epoxy Coated				
4.12	Stuffing Box	SS-316	SS-316	SS-316	SS-316	SS 316
4.13	Casing Wearing rings (If applicable)	SS 316	SS 316	SS 316	SS 316	SS 316
4.14	Coupling	SS-316	SS-316	SS 316	SS 316	SS 316
4.15	Connecting Pipe material (for deciding counterflange material)	Carbon Steel as per IS:2062, Plates rolled & welded as per IS 3589	Carbon Steel as per IS:2062, Plates rolled & welded as per IS 3589	ASTM-A-312 TP 304, ERW	ASTM-A-312 TP 304, ERW	ASTM-A-312 TP 304, ERW
5.0	MANDATORY SPARES					
5.1	Complete Impeller Assembly	1 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps
5.2	Keys for impeller	1 No. for each application and ratings of Pumps	1 No. for each application and ratings of Pumps	1 No. for each application and ratings of Pumps	1 No. for each application and ratings of Pumps	1 No. for each application and ratings of Pumps
5.3	Pump shaft	1 No. for each application and ratings of Pumps	1 No. for each application and ratings of Pumps	1 No. for each application and ratings of Pumps	1 No. for each application and ratings of Pumps	1 No. for each application and ratings of Pumps
5.4	Bearings (comprising of Drive & Non-drive end)	1 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps
5.5	Wear Ring for Casing& Impeller	1 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps
5.6	Complete Set of Mechanical seal	1 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps
5.7	Coupling	1 No. for each application and ratings of Pumps	1 No. for each application and ratings of Pumps	1 No. for each application and ratings of Pumps	1 No. for each application and ratings of Pumps	1 No. for each application and ratings of Pumps
6.0	COMMISSIONING SPARES					
6.1	Bearings (comprising of Drive & Non-drive end)	2 Set for each application and ratings of Pumps	2 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps
6.2	Complete Set of Mechanical seal	2 Set for each application and ratings of Pumps	2 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps

	DATA SHEET - A				SPECIFICATION NO.:	PE-TS-411-100-N001
	MISCELLANEOUS PUMPS (HORIZONTAL) - GROUP-I				REV. NO.: 00	DATE : 30/07/2015
	4X270MW BHADRADRI TPS				VOLUME : II B	SECTION : D
Sl. No.	DESCRIPTION	DMCW PUMPS	DMCW BOOSTER PUMPS	HOTWELL MAKE-UP PUMPS	DM TRANSFER PUMPS	BOILER FILL PUMPS
	Spares Note: 1. In case if such items of spares indicated as "not applicable" by bidder in its offer, are found applicable at a later date during execution of the project, such items of spares are to be supplied within the ordered cost of the mandatory spares. 2. In respect of quantity mentioned as 'Set' means the total quantity of all the components/items used in particular equipment unless otherwise specified.					
7.0	BID EVALUATION RATE					
7.1	Bid evaluation rate	Rs. 1.09 Lacs/KW	Rs. 1.09 Lacs/KW	NA	NA	NA
7.2	Maximum permissible efficiency for Bid evaluation					
7.2.1	Pump Efficiency (%)	86	85	-	-	-
7.2.2	Motor Efficiency (%)	94	93	-	-	-
Notes :						
1	Material of construction for other components not specified above shall be similarly selected in line with the above for the duty intended and subject to approval.					
2	For items stated as not applicable by bidder, shall have to be supplied without any cost implication to BHEL in the event they are found to be applicable during detail engineering stage.					
3	For all HT motor driven pumps (wherever applicable), bidder shall provide flat surface with dimensions 60 MM x60 MM on bearing Housing for mounting vibration measuring block and a key slots of dimensions 30MM (L) X 15 MM (W) X 3 MM (D) on each pump shaft or some other suitable location which shall be confirmed during detail engineering by BHEL for Phase Marker.					
4	Wherever SS material is coming in contact with non SS material, suitable isolation (rubber etc.) shall be provided to avoid galvanic corrosion.					



DATA SHEET - A						SPECIFICATION NO.:	PE-TS-411-100-N001
MISCELLANEOUS PUMPS (Vertical Pumps) - GROUP-II						REV. NO.: 00	DATE : 30.07.15
4X270MW BHADRADRI TPS		VOLUME : II B	SECTION D				
Sl. No.	DESCRIPTION	RAW WATER PUMPS	ACW PUMPS	CW MAKE-UP PUMPS	SERVICE WATER PUMPS	APH/SEP WATER WASHING PUMPS	Potable Water Pumps
1.0	SERVICE						
1.1	Total no. of pumps for Project	3	Total 12 nos. viz. 3 (three) nos. per unit	3	3	2	2
1.2	No. of working & standby pumps	(2W+1S) for station	(2W+1S) per unit	(2W+1S) for station	(2W+1S) for station	(1W+1S) for station	(1W+1S) for station
1.3	Liquid Handled (ref. water analysis enclosed herein)	Raw Water (River water)	Clarified Water	Clarified Water	Clarified Water	Clarified Water	Clarified Water
1.4	Location	Raw Water P/H	CW/ACW P/H	Clarified Water P/H	Clarified Water P/H	Clarified Water P/H	Clarified Water P/H
1.4.1	Indoor / Outdoor	Indoor	Indoor	Indoor	Indoor	Indoor	Indoor
1.5	Duty	Continuous	Continuous	Continuous	Continuous	Intermittent	Intermittent
1.6	Specific gravity	1	1	1	1	1	1
1.7	No. of pumps working in parallel	2	2	2	2	-	-
1.8	System design pressure (kg/sqcm)	10	7.5	5	10	-	10
2.0	DESIGN PARAMETERS						
2.1	Design capacity each, M ³ /hr	2300	1280	1550	250	330	25
2.2	Total dynamic head (MWC) (At Bowl, excluding Pumps internal frictional losses upto discharge)	27	37.5	21	66	75	52
2.3	• Suction Pressure(MWC)	Submerged Suction	Submerged Suction	Submerged Suction	Submerged Suction	Submerged Suction	Submerged Suction
	• Floor Level- for Pump Mounting	RL (+) 72.5 M	RL (+) 70.5 M	RL (+) 69.0 M	RL (+) 69.0 M	RL (+) 69.0 M	RL (+) 69.0 M
	• Min. W. L.	RL (+) 65.9 M	RL (+) 66.23 M	RL (+) 66.0 M	RL (+) 66.0 M	RL (+) 66.0 M	RL (+) 66.0 M
	• Max. W. L.	RL (+) 71.5 M	RL (+) 69.0 M	RL (+) 68.0 M	RL (+) 68.0 M	RL (+) 68.0 M	RL (+) 68.0 M
	• Sump Invert Level	RL (+) 63.4 M	RL (+) 66.23 M	RL (+) 63.5 M	RL (+) 63.5 M	RL (+) 63.5 M	RL (+) 63.5 M
	• Crane Hook Level	RL (+) 78.5 M	RL (+) 83.0 M	RL (+) 74.0 M	RL (+) 74.0 M	RL (+) 74.0 M	RL (+) 74.0 M
	• Crane Capacity Available	5 Ton	30 Ton	5 Ton	5 Ton	5 Ton	5 Ton
2.4	Design Temperature (°C)	60	60	60	60	60	60
2.5	Maximum permissible speed of pump (RPM) (with Motor rpm fixed only for HT drives as 1500 rpm)	1500	1500	1500	1500	1500	1500
2.6	Max. limit on shut off head Corresponding to pump TDH (MWC) at 51.5 Hz	Not to exceed 95 MWC	Not to exceed 85 MWC	Not to exceed 42 MWC	Not to exceed 95 MWC	Not to exceed 97 MWC	Not to exceed 95 MWC
2.7	Pump Discharge - above floor / below floor			Above Floor			
2.8	Discharge pipe (ODXTHK),(mmmm)	610 X 6.0	406.4X 6.0	508 X 6.0	219.1 X 6.0	166.5 X 5.4	115 X 5.4
2.9	Operating range			30-130% of design duty point flow			
2.10	Motor rating	Drive Motor rating (including voltage and frequency variation), at an ambient temp. of 50 Deg C, shall be minimum 250KW (HT Motor in BHEL scope). The following condition (maximum) shall also be fulfilled while selecting the motor rating : a) 15% margin over the pump shaft input power at the rated duty point. b) 10% margin over the maximum pump shaft input power required within the entire characteristic curve of the pump. c) Pump shaft input power required considering the overloading of the pump assuming single pump operation in the event of tripping of one or more of the pumps operating in parallel.	Drive Motor rating (including voltage and frequency variation), at an ambient temp. of 50 Deg C, shall be minimum 200 KW (HT Motor in BHEL scope). The following condition (maximum) shall also be fulfilled while selecting the motor rating : a) 15% margin over the pump shaft input power at the rated duty point. b) 10% margin over the maximum pump shaft input power required within the entire characteristic curve of the pump. c) Pump shaft input power required considering the overloading of the pump assuming single pump operation in the event of tripping of one or more of the pumps operating in parallel.	Motor rating at ambient temperature of 50 Deg.Cel. (including voltage and frequency variations) shall be the maximum of the following requirements: a) 15% margin over the pump shaft input power at the rated duty point. b) 10% margin over the maximum pump shaft input power required within the entire characteristic curve of the pump. c) Pump shaft input power required considering the overloading of the pump assuming single pump operation in the event of tripping of one or more of the pumps operating in parallel.			
2.11	Permissible tolerance in rated capacity & TDH			No negative tolerance			
2.12	Permissible tolerance in efficiency at rated capacity(%)			No negative tolerance			
2.13	Performance/Design Standard	HIS / IS1710					
3.0	CONSTRUCTION FEATURES						
3.1	Pump type	Vertical Turbine Type	Vertical Turbine Type	Vertical Turbine Type	Vertical Turbine Type	Vertical Turbine Type	Vertical Turbine Type
3.2	Impeller type	Closed	Closed	Closed	Closed	Closed	Closed
3.3	Casing type	Vertical Turbine Type					
3.4	Coupling type	Flexible	Flexible	Flexible	Flexible	Flexible	Flexible
3.5	Sealing arrangement	Self Water/Gland packing	Self Water/Gland packing	Self Water/Gland packing	Self Water/Gland packing	Self Water/Gland packing	Self Water/Gland packing
3.6	Type of Lubrication	Self Water	Self Water	Self Water	Self Water	Self Water	Self Water
3.7	Pump characteristics	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable
3.8	Reverse flow through pump to be considered for pump design	YES	YES	YES	YES	YES	YES
3.9	Drain Plugs, vent, lifting lugs, etc.	To be Provided					
4.0	MATERIALS OF CONSTRUCTION						
4.1	Casing & Suction Bell	2% Ni CI IS 210 Gr. FG 260	2% Ni CI IS 210 Gr. FG 260	2% Ni CI IS 210 Gr. FG 260	2% Ni CI IS 210 Gr. FG 260	2% Ni CI IS 210 Gr. FG 260	2% Ni CI IS 210 Gr. FG 260
4.2	Column Pipe/Discharge Elbow	CS to IS 2062 Gr.B	CS to IS 2062 Gr.B	CS to IS 2062 Gr.B	CS to IS 2062 Gr.B	CS to IS 2062 Gr.B	CS to IS 2062 Gr.B
4.3	Minimum column pipe/Discharge elbow thickness, mm	10 mm	10 mm	10 mm	10 mm	10 mm	10 mm
4.4	Impeller	ASTM-A-351 Gr.CF8M	ASTM-A-351 Gr.CF8M	ASTM-A-351 Gr.CF8M	ASTM-A-351 Gr.CF8M	ASTM-A-351 Gr.CF8M	ASTM-A-351 Gr.CF8M
4.5	Shaft/ Line Shaft	SS-410	SS-410	SS-410	SS-410	SS-410	SS-410
4.6	Shaft Sleeves	SS-410 (Hardened)	SS-410 (Hardened)	SS-410 (Hardened)	SS-410 (Hardened)	SS-410 (Hardened)	SS-410 (Hardened)
4.7	Shaft Coupling	SS-410 (Hardened)	SS-410 (Hardened)	SS-410 (Hardened)	SS-410 (Hardened)	SS-410 (Hardened)	SS-410 (Hardened)
4.8	Gland	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316
4.9	Wearing rings	SS-410	SS-410	SS-410	SS-410	SS-410	SS-410
4.10	Wetted fasteners	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316
4.11	Stuffing Box	2% Ni CI IS 210 Gr. FG 260	2% Ni CI IS 210 Gr. FG 260	2% Ni CI IS 210 Gr. FG 260	2% Ni CI IS 210 Gr. FG 260	2% Ni CI IS 210 Gr. FG 260	2% Ni CI IS 210 Gr. FG 260
4.12	Lantern Ring	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316
4.13	Intermediate stage bearings	Cutless rubber/Thordon Type	Cutless rubber/Thordon Type	Cutless rubber/Thordon Type	Cutless rubber/Thordon Type	Cutless rubber/Thordon Type	Cutless rubber/Thordon Type
4.14	Mech. seal	N/A	N/A	N/A	N/A	N/A	N/A
4.15	Gland Packing (Asbestos Free)	Braided Impregnated Teflon (Asbestos Free)	Braided Impregnated Teflon (Asbestos Free)	Braided Impregnated Teflon (Asbestos Free)	Braided Impregnated Teflon (Asbestos Free)	Braided Impregnated Teflon (Asbestos Free)	Braided Impregnated Teflon (Asbestos Free)
4.16	Base/ Sole Plate	MS to IS 2062 Gr. B (min. 10 mm thk)					
4.17	Connecting Pipe material (for deciding counterflange material)	Piping shall be Carbon Steel (IS:2062), rolled and welded conforming to IS:3589 .					
5.0	MANDATORY SPARES						
5.1	Complete Impeller Assembly	1 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps
5.2	Keys for impeller	1 No. for each application and ratings of Pumps	1 No. for each application and ratings of Pumps	1 No. for each application and ratings of Pumps	1 No. for each application and ratings of Pumps	1 No. for each application and ratings of Pumps	1 No. for each application and ratings of Pumps
5.3	Pump shaft	1 No. for each application and ratings of Pumps	1 No. for each application and ratings of Pumps	1 No. for each application and ratings of Pumps	1 No. for each application and ratings of Pumps	1 No. for each application and ratings of Pumps	1 No. for each application and ratings of Pumps
5.4	Bearings Various types as applicable	Complete 1(One) Set (one set means total requirements for one Pump) for each type	Complete1(One)Set(one set means total requirements for one Pump)	Complete 1(One) Set (one set means total requirements for one Pump) for each type	Complete1(One)Set(one set means total requirements for one Pump)	Complete 1(One) Set (one set means total requirements for one Pump) for each type	Complete1(One)Set(one set means total requirements for one Pump)
5.5	Wear Ring for Casing& Impeller	1 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps
5.6	Complete Set of Gland Packing	1 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps
5.7	Coupling	1 No. for each application and ratings of Pumps	1 No. for each application and ratings of Pumps	1 No. for each application and ratings of Pumps	1 No. for each application and ratings of Pumps	1 No. for each application and ratings of Pumps	1 No. for each application and ratings of Pumps
6.0	COMMISSIONING SPARES						
6.1	Bearings Various types as applicable	1 Set for each application and ratings of Pumps	2 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps
6.2	Complete Set of Gland Packing	1 Set for each application and ratings of Pumps	2 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps	1 Set for each application and ratings of Pumps
Spares Note: 1. In case if such items of spares indicated as "not applicable" by bidder in its offer, are found applicable at a later date during execution of the project, such items of spares are to be supplied within the ordered cost of the mandatory spares. 2. In respect of quantity mentioned as 'Set' means the total quantity of all the components/items used in particular equipment unless otherwise specified.							
7.0	Bid Evaluation						
7.1	Bid evaluation rate	Rs.1.09 Lacs/KW	Rs.1.09 Lacs/KW	Rs.1.09 Lacs/KW	Rs.1.09 Lacs/KW	-	-
7.2	Maximum permissible efficiency for Bid evaluation						
7.2.1	Pump Efficiency	86	86	86	81	-	-
7.2.2	Motor Efficiency	94	94	95	94.5	-	-
Notes :							
1	Material of construction for other components not specified above shall be similarly selected in line with the above for the duty intended and subject to approval.						
2	For items stated as not applicable by bidder, shall have to be supplied without any cost implication to BHEL in the event they are found to be applicable during detail engineering stage.						
3	For all HT motor driven pumps (wherever applicable), bidder shall provide flat surface with dimensions 60 MM x60 MM on bearing Housing for mounting vibration measuring block and a key slots of dimensions 30MM (L) X 15 MM (W) X 3 MM (D) on each pump shaft or some other suitable location which shall be confirmed during detail engineering by BHEL for Phase Marker.						
4	Wherever SS material is coming in contact with non SS material, suitable isolation (rubber etc.) shall be provided to avoid galvanic corrosion.						

TELANGANA STATE POWER GENERATION CORPORATION LIMITED



TEST REPORT BY ENVIRONMENT SUB DIVISION

1. Sample Name : GODAVARI RIVER WATER
2. Location : AT MANUGURU
3. Sampling date : 09-10-2014.
4. Reporting date : 10-10-2014.

S.NO	TESTING PARAMETER	RESULT
1.	pH	7.73
2.	Conductivity(micro Siemens/cm)	328
3.	Dissolved solids(mg/litre)	218
4.	Total Hardness as CaCO ₃ , mg/litre	94
5.	Calcium as Ca, mg/litre	60
6.	Magnesium as Mg,mg/litre	34
7.	Total Alkanity as CaCO ₃ , mg/litre	140
8.	Chlorides as Cl, mg/litre	30
9.	Sulphates as SO ₄ ,mg/litre	58
10.	Silica as SiO ₂ ,mg/litre	5.20
11.	Iron as Fe,mg/litre	0.007
12.	Turbidity (NTU)	16

[Signature]
10/10/14
CHEMIST/ENV.SUB.DVN

1. 10/10/14
SBC

CLARIFIED WATER ANALYSIS WITH COC OF 5.

CLAUSe NO.	PROJECT SYNOPSIS																			
	DM water Analysis																			
	<table> <tr> <th>Sl.No.</th><th>Characteristics</th><th>Value</th></tr> <tr> <td>1.</td><td>Silica (Max.)</td><td>0.02 ppm as SiO₂</td></tr> <tr> <td>2.</td><td>Iron as Fe</td><td>Nil</td></tr> <tr> <td>3.</td><td>Total hardness</td><td>Nil</td></tr> <tr> <td>4.</td><td>pH value</td><td>6.8 to 7.2</td></tr> <tr> <td>5.</td><td>Conductivity</td><td>Not more than 0.1 μS/cm excluding the effects of free CO₂</td></tr> </table>	Sl.No.	Characteristics	Value	1.	Silica (Max.)	0.02 ppm as SiO ₂	2.	Iron as Fe	Nil	3.	Total hardness	Nil	4.	pH value	6.8 to 7.2	5.	Conductivity	Not more than 0.1 μ S/cm excluding the effects of free CO ₂	
Sl.No.	Characteristics	Value																		
1.	Silica (Max.)	0.02 ppm as SiO ₂																		
2.	Iron as Fe	Nil																		
3.	Total hardness	Nil																		
4.	pH value	6.8 to 7.2																		
5.	Conductivity	Not more than 0.1 μ S/cm excluding the effects of free CO ₂																		
	PASSIVATED DM WATER pH = 8.5 to 9.5																			



BHARAT HEAVY ELECTRICALS LIMITED
PROJECT ENGINEERING MANAGEMENT
STANDARD QUALITY PLAN

Rev-01

QUALITY PLAN FOR MISCELLANEOUS PUMPS				CUSTOMER		PROJECT TITLE						
				BIDDER/VENDOR		QUALITY PLAN NUMBER		PE-QP-999-100-N004 (For Hor. Pumps) PE-QP-999-100-N004 (For Ver. Pumps)				
SHEET 1 OF 6				SYSTEM		ITEM - CENTRIFUGAL PUMPS (HORIZONTAL / VERTICAL)						
S. No.	COMPONENT / OPERATION	CHARACTERISTIC CHECKED	CATEGORY	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
1	MATERIALS CONTROL											
1.1	CASINGS (INCLUDING BOWLS, DIFFUSERS, STAGE BODIES, DISCH HEAD (IF CAST)), ETC. - (AS APPLICABLE) AND IMPELLER	MECHANICAL AND CHEMICAL PROPS	CR	MECHANICAL AND CHEM. ANALYSIS	ONE/HEAT/BATCH	APPROVED CS DRAWING/DATA SHEET	RELEVANT MATERIAL SPECN.	LAB REPORT/ MTC	3/2.		2,1	
1.2	STUFFING BOX, SUCTION BELL, WEARING RINGS, NECK RINGS, SHAFT SLEEVES	DO-	MA	MECHANICAL AND CHEM. ANALYSIS	ONE/HEAT/BATCH	APPROVED CS DRAWING/DATA SHEET	RELEVANT MATERIAL SPECN.	LAB REPORT/ MTC	3/2.		2,1	
		HARDNESS DIFFERENCE BETWEEN CASING / IMPELLER AND WEARING RING	MA	LAB. TEST	100%	APPROVED CS DRAWING/DATA SHEET	50 BHN MIN.	LAB. REPORT	3/2.		2,1	
1.3	BARS/FORGINGS FOR SHAFTS, LINE SHAFTS	1. PHYSICAL & CHEMICAL PROPS	CR	1. MECHANICAL & CHEMICAL ANALYSIS.	1/CAST OR 1/BARS	APPROVED CS DRAWING/DATA SHEET	RELEVANT MATERIAL SPECN.	MILL T.C. OR LAB. REPORT	3/2.		2,1	CORRELATION REQUIRED, IDENTIFICATION AS PER TC
		2. DIMENSIONS	CR	2. MEASUREMENT	100%	MFR. DRAWING	MFR. DRAWING	INSP. REPORT	3/2.		2,1	
		3. INTERNAL DEFECTS FOR 40MM & ABOVE DIA SHAFTS.	CR	3. ULTRA SONIC TEST	100%	ASTMA388 BACK WALL ECHO 100%	DEFECT ECHO MAX 20% OF B.W.E. LOSS OF BACK WALL ECHO 20% MAX	NDT CERTIFICATE	3/2.		2,1	
1.4	STRESS RELIEVING/ HEAT TREATMENT OF CASTING OF ALL ABOVE (IF APPLICABLE) / SOLUTION ANNEALING OF SS CASTING	1. VERIFICATION OF HT CHART	MA	VERIFICATION OF SR/HT CHART	ALL BATCHES	RELEVANT MATERIAL SPECN.	DO-	CORRELATED SR/HT. CHARTS	3/2.		2,1	
		2. IGC TEST FOR SS CASTING	MA	LAB. TEST	ONE SAMPLE/ HT BATCH	ASTM A 262	ASTM A 262 Gr A	LAB. REPORT	3/2.		2,1	
1.5	SHAFT ENCLOSING TUBES, COLUMN PIPES & DISCHARGE ELBOW	1. MECHANICAL & CHEMICAL PROPS. 2. DIMENSIONS. 3. SURFACE FINISH	MA	1. MECH & CHEM TEST 2. MEASUREMENT 3. VISUAL EXAM	1/BATCH 100% 100%	APPROVED GA DRG./DATA SHEET	RELEVANT MATERIAL SPECN./MAFG./ APPROVED DOCS	MFR T.C OR LAB. REPORT	3/2.		2,1	
BHEL				PARTICULARS			BIDDER / VENDOR					
				NAME								
				SIGNATURE								
				DATE						BIDDER/VENDOR SEAL		

NAME	Prepared By AJAY JAIN <i>Ajay</i>	Reviewed By ASHWANI KHANNA <i>Ashwani</i>	Approved By I. J. SINGH <i>I. J. Singh</i>
SIGN.			
DATE	23-07-2012	23-07-2012	23-07-2012



BHARAT HEAVY ELECTRICALS LIMITED
PROJECT ENGINEERING MANAGEMENT
STANDARD QUALITY PLAN

Rev-01

QUALITY PLAN FOR MISCELLANEOUS PUMPS				CUSTOMER		PROJECT TITLE						
				BIDDER/VENDOR		QUALITY PLAN NUMBER						
SHEET 2 OF 6				SYSTEM		ITEM - CENTRIFUGAL PUMPS (HORIZONTAL / VERTICAL)						
S. No.	COMPONENT / OPERATION	CHARACTERISTIC CHECKED	CATEGORY	TYPE/METHOD OF CHECKED	EXTENT OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
1.6	PLATE FLANGE, C/FLANGE	1. MECHANICAL & CHEMICAL PROS. 2. DIMENSIONS. 3. SURFACE FINISH	MA	1. MECH & CHEM TEST 2. MEASUREMENT 3. VISUAL EXAM	1/CAST 100% 100%	APPROVED GA DRG./DATA SHEET	RELEVANT MATERIAL SPECN./ MFR. DRG./ APPROVED DOC	MILL TC/ LAB REPORT	3/2.		2,1	CORRELATION REQ. FOR MAT OTHER THAN IS 2062
1.7	SUCTION STRAINER (IF APPLICABLE)	MECHANICAL & CHEMICAL PROS.	MI	MECH. & CHEMICAL TEST	1/HEAT	APPROVED GA DRG./DATA SHEET	RELEVANT MATERIAL SPECN./ MFR. DRG./ APPROVED DOC	MILL TC/ LAB REPORT	3/2.		2,1	
1.8	MECHANICAL SEAL (IF APPLICABLE)	TYPE, SIZE, MFRS, NO., MAKE	MA	VISUAL EXAM	100%	APPROVED DATASHEET / GA MECH. SEAL	APPROVED DATASHEET		3/2.		2,1	COMPLIANCE TC FOR APPROVED MAKE
1.9	PUMP BEARINGS	TYPE, SIZE, MFRS, NO., MAKE	MA	VISUAL EXAM	100%	APPROVED DATASHEET	APPROVED DATASHEET		3/2.		2,1	COMPLIANCE TC FOR APPROVED MAKE
2.0 IN PROCESS CONTROL												
2.1	ALL COMPONENTS UNDER 1.00 ABOVE	VISUAL DEFECTS, DIMENSIONS	MA	VISUAL EXAM, MEASUREMENT	100%	MFG. DRAWING	MFG. DRAWING	COMPLIANCE TC	3/2.		2,1	
2.2	IMPELLER	CLEANING AND DEBURRING	MA	VISUAL	100%	MFG. DRAWING	MFG. DRAWING		3/2.		2,1	
	IMPELLER	DYNAMIC BALANCING	CR	DYNAMIC BALANCING	100%	ISO 1940	ISO1940 Gr 6.3	BALANCING CERTIFICATE	3/2.	2,1		WTNESSING ONLY FOR SIZE GREATER THAN 10KW
2.3	IMPELLER-ALL ACCESSIBLE SURFACES, DIFFUSERS	DP TEST	MA	DP TEST ON M/CED AREA	100%	APPENDIX 8 OF ASME SEC. VIII DIV. 1		NDT CERTIFICATE	3/2.	2,1		WTNESS BY BHEL & VARIFICATION BY CUSTOMER
2.4	WERING RING, SHAFT SLEEVES, CASING	DP TEST	MA	DP TEST ON M/CED AREA	100%	APPENDIX 8 OF ASME SEC. VIII DIV. 1		NDT CERTIFICATE	3/2.		2,1	
2.5	SHAFT	DP TEST	MA	DP TEST ON M/CED AREA	100%	ASTM E 165	NO RELEVANT INDICATION ALLOWED	NDT CERTIFICATE	3/2.	2,1		WTNESS BY BHEL & VARIFICATION BY CUSTOMER
2.6	CASINGS/ BOWLS, STAGE BODIES, DISCHARGE HEAD (IF CAST), SUCTION HOUSING, COLUMN PIPE DISCHARGE PIPE ETC	LEAK TIGHTNESS	CR	VISUAL	100%	TECHNICAL DATA SHEET AND NOTE 2	NO LEAKAGE FOR TEST DURATION OF 30 MIN.	HT CERTIFICATE	3/2.	2,1		HAMMERING OF CASTINGS WITH WOODEN/ RUBBER MALLET BEFORE HYDRO TEST
BHEL				PARTICULARS		BIDDER / VENDOR						
				NAME								
				SIGNATURE								
				DATE					BIDDER/VENDOR SEAL			

NAME SIGN. DATE	Prepared By AJAY JAIN <i>Ajay</i> 23-07-2012	Reviewed By ASHWANI KHANNA <i>Ashwani</i> 23-07-2012	Approved By I. J. SINGH <i>I. J. Singh</i> 23-07-2012
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BHARAT HEAVY ELECTRICALS LIMITED
PROJECT ENGINEERING MANAGEMENT
STANDARD QUALITY PLAN

Rev-01

QUALITY PLAN FOR MISCELLANEOUS PUMPS				CUSTOMER		PROJECT TITLE						
				BIDDER/VENDOR		QUALITY PLAN NUMBER						
SHEET 3 OF 6				SYSTEM		ITEM - CENTRIFUGAL PUMPS (HORIZONTAL / VERTICAL)						
S. No.	COMPONENT / OPERATION	CHARACTERISTIC CHECKED	CATEGORY	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
2.7	FABRICATED COMPONENTS											WELDING PROCEDURE APPROVAL BY BHEL ALT. 3RD PARTY (LLYODS, BVQI OR EQ.) IS ACCEPTABLE.
2.7.1	WELDING PROCEDURE SPECIFICATION	CORRECTNESS	MA	EXAM.	100%	ASME SEC.IX	ASME SEC.IX	QW 482 OF ASME SEC.IX	3/2.		2,1	
2.7.2	WELDING PROCEDURE QUALIFICATION	WELD SOUNDNESS	MA	VISUAL,PHYS. TESTS RT (AS APPLICABLE)	100%	ASME SEC.IX	ASME SEC.IX	QW 483 OF ASME SEC.IX	3/2.		2,1	
2.7.3	WELDER PERFORMANCE QUALIFICATION	WELD SOUNDNESS	MA	VISUAL,PHYS. TESTS RT (AS APPLICABLE)	100%	ASME SEC.IX	ASME SEC.IX	QW 484 OF ASME SEC.IX	3/2.		2,1	
2.7.4	WELD FIT-UPS	DIMENSION & ALIGNMENT	MA	MEAS.VISUAL EXAM	100%	WPS, MFG . DRAWING	WPS, MFG . DRAWING	IR/LOGBOOK	3/2.			
2.7.5	ROOT RUNS	SURFACE DEFECTS	MA	PENETRANT TEST	100%	ASTM E 165	NO SURFACE DEFECT	DO.	3/2.		2, 1	
2.7.6	WELDMENTS	SURFACE DEFECTS	MA	PENETRANT TEST	100%	ASTM E 165	ASME-VIII,DIV I	INSPN REPORT	3/2.		2,1	
BHEL				PARTICULARS		BIDDER / VENDOR						
				NAME								
				SIGNATURE								
				DATE								
BIDDER/VENDOR SEAL												

NAME	Prepared By AJAY JAIN	Reviewed By ASHWANI KHANNA	Approved By I. J. SINGH
SIGN.			
DATE	23-07-2012	23-07-2012	23-07-2012



BHARAT HEAVY ELECTRICALS LIMITED
PROJECT ENGINEERING MANAGEMENT
STANDARD QUALITY PLAN

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QUALITY PLAN FOR MISCELLANEOUS PUMPS				CUSTOMER		PROJECT TITLE						
				BIDDER/VENDOR		QUALITY PLAN NUMBER						
SHEET 4 OF 6				SYSTEM		ITEM - CENTRIFUGAL PUMPS (HORIZONTAL / VERTICAL)						
S. No.	COMPONENT / OPERATION	CHARACTERISTIC CHECKED	CATEGORY	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
2.7.7	BUTT WELDS	INTERNAL DEFECT	MA	UT/RT	100%			IR	3/2.		2.1	
2.7.8	DICHARGE HEAD, COLUMN PIPE, DISCHARGE PIPE, ETC.	1. LEAK TIGHTNESS 2. DIMENSION	CR	1. HYDROTEST 2. MEASUREMENT	100%	TECHNICAL SPEC/ DATA SHEET, MFR DRAWING	1. NO LEAKAGE 2. MFR. DRAWING	IR	3/2.	2.1		
3.0	SUB-ASSEMBLY CONTROL											
3.1	ROTOR ASSEMBLY	ECCENTRICITY	MA	MEASUREMENT	100%	MFR.DRAWING	MFR.DRAWING	IR/LOG BOOK	3/2.		1	
3.2	ROTOR ASSEMBLY RESIDUAL UNBALANCE	STATIC & DYNAMIC	CR	STATIC & DYNAMIC BALANCING	100%	ISO 1940	ISO1940 Gr 6.3	BALANCING CERTIFICATE	3/2.	2.1		WTNESSING ONLY FOR SIZE GREATER THAN 10KW
3.3	COMPLETE PUMP ASSEMBLY	COMPLETENESS, CORRECTNESS, CLEANLINESS, CLEARANCES, FREENESS, ALIGNMENT	MA	VISUAL EXAM MEASUREMENT	100%	APPROVED DRG & MFG STANDARDS	APPROVED DRG & MFG STANDARDS	I.R. & CHECK LISTS	3/2.		2.1	
BHEL				PARTICULARS		BIDDER / VENDOR						
				NAME								
				SIGNATURE								
				DATE					BIDDER/VENDOR SEAL			

NAME	Prepared By AJAY JAIN 	Reviewed By ASHWANI KHANNA 	Approved By I. J. SINGH
SIGN.			
DATE	23-07-2012	23-07-2012	23-07-2012



BHARAT HEAVY ELECTRICALS LIMITED
PROJECT ENGINEERING MANAGEMENT
STANDARD QUALITY PLAN

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QUALITY PLAN FOR MISCELLANEOUS PUMPS				CUSTOMER		PROJECT TITLE						
				BIDDER/VENDOR		QUALITY PLAN NUMBER						
SHEET 5 OF 6				SYSTEM		ITEM - CENTRIFUGAL PUMPS (HORIZONTAL / VERTICAL)						
S. No.	COMPONENT / OPERATION	CHARACTERISTIC CHECKED	CATEGORY	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
4	FINAL INSPECTION, TESTS & PACKING DESPATCH CONTROL											
4.1	PUMP WITH JOB/SHOP MOTOR ASSEMBLED ON INDIVIDUAL BASE FRAME	1. Q V/S HEAD, 2. Q V/S POWER, 3. Q V/S PUMP EFF. 4. VIBRATION 5. NOISE 6. BEARING TEMP. 7. LEAKAGES	CR	PERFORMANCE TEST	100%	APPD. PERFORMANCE TEST PROCEDURE/ APPD. DATA SHEET/APPD. CURVES FOR VIBRATIONS - AS PER ANSI/HIS 9.6.4-2009 (VALUES AS PER APPROVED DATA SHEET) FOR BEARING TEMP - BEARING HOUSING SHOULD NOT BE UNTOUCHABLY HOT. FOR LEAKAGE - MINOR LEAKAGE (DROP BY DROP) IN CASE OF GLAND PACKING ARRANGEMENT.	I.R., PERF. TEST RECORD, PLOTTED CURVES	3/2.	2,1.			* MINIMUM 7 POINTS FROM SHUT-OFF TO MAX. OPERATING FLOW COVERING ENTIRE OPERATION RANGE OF PUMP SHALL BE TAKEN.
		NPSH/ MIN. SUBMERGENCE REQUIRED	CR	NPSH TEST	1/MODEL	DO.	IR. NPSH/MIN. SUBMERGENCE TEST RECORD, PLOTTED CURVES	3/2.	2,1.			IF SPECIFIED or INSISTED BY CUSTOMER.
4.2	STRIP DOWN AFTER PERFORMANCE TEST	1. UNDUE WEAR TEAR AND RUBBING	MA	VISUAL EXAM AFTER STRIPPING	1/MODEL	NO UNDUE WEAR TEAR & RUBBING ON IMPELLER & WEAR RING	INSP. REPORT	3/2.	1			WITNESS REQUIRED ONLY WHEN ABNORMAL SOUND OBSERVED DURING PERFORMING TEST.
4.3	COMPLETE PUMP WITH UNIT MOTOR BASE FRAME, COUNTER FLANGES ETC. INCLUDING ALL ACCESSORIES AS PER SECTION C OF SPECN.	COMPLETENESS, CLEANLINESS, OVERALL DIMENSIONS ORIENTATION, WORKMANSHIP AND FINISH	MA	VISUAL EXAM MEASUREMENT	100%	APPD. G.A DRAWING	APPD. G.A DRAWING	INSP. REPORT	3/2.	1		
BHEL				PARTICULARS			BIDDER / VENDOR					
				NAME								
				SIGNATURE								
				DATE						BIDDER/VENDOR SEAL		

NAME	Prepared By AJAY JAIN <i>Ajay</i>	Reviewed By ASHWANI KHANNA <i>Ashwani</i>	Approved By I. J. SINGH <i>I. J. Singh</i>
SIGN.			
DATE	23-07-2012	23-07-2012	23-07-2012



BHARAT HEAVY ELECTRICALS LIMITED
PROJECT ENGINEERING MANAGEMENT
STANDARD QUALITY PLAN

Rev-01

QUALITY PLAN FOR MISCELLANEOUS PUMPS				CUSTOMER		PROJECT TITLE				
				BIDDER/VENDOR		QUALITY PLAN NUMBER				
SHEET 6 OF 6				SYSTEM		ITEM - CENTRIFUGAL PUMPS (HORIZONTAL / VERTICAL)				

S. No.	COMPONENT / OPERATION	CHARACTERISTIC CHECKED	CATEGORY	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
4.4	COMPLETION OF ALL STAGES	1.COMPLETION	MA	VERIFICATION OF IR/T.C.ETC.	100%	MFG. DRG./TECHNICAL DOCS.	APPD. MFG. DRG./TECHNICAL DOCS	IR.	3/2.	2,1		WITNESSING ONLY BY BHEL. CUSTOMER VERIFICATION ONLY BUT CHP
4.5	PAINTING	1.SURFACE FINISH, DFT, MARKINGS ETC.	MA	VISUAL EXAM MEASUREMENT AESTHETIC	100%	APPD.DRG.	APPD.DOCS	IR.	3/2.		2	
4.6	PACKING, MARKING	SOUNDNESS OF PACKING	MI	VISUAL AESTHETIC	100%	MFG. STANDARD	MFG. STANDARD		3/2.		2	

MTC -Mill Test Certificate, MA-Major, MI-Minor, TC-Test Certificate, CR-Critical, IGC- Inter Granular Corrosion

- 1.AS CAST HEAT MARKS SHALL BE PROVIDED ON CI CASTING LIKE TOP & BOTTOM CASING.
2. HYDRO TEST PRESSURE SHALL BE AT LEAST 2(TWO) TIMES THE DUTY POINT (OR) 1.5 TIMES OF SHUT OFF HEAD (OR) SYSTEM DESIGN PRESSURE, WHICHEVER IS HIGHER.
3. THIS QAP IS ALSO APPLICABLE FOR SPARES.
4. NO WELD REPAIRS PERMISSIBLE ON CI CASTING.
5. MATERIAL SHALL BE AS PER APPROVED CROSS SECTION DRG./ DATA SHEET.
6. STRIP TEST- INCASE OF ABNORMAL NOISE OBSERVED DURING PERF. TEST, THOSE PUMP WILL BE STRIPPED DOWN FOR VISUAL INSPECTION OF IMPELLER & WEAR SHALL BE OFFERED FOR VISUAL INSPECTION FOR WEAR /RUBBING MARKS.
7. PUMPS WITH MECHANICAL SEAL ARRANGEMENT TO BE TESTED AND SUPPLIED WITH GLAND PACKING ARRANGEMENT. HOWEVER MANUFACTURER TO ENSURE DIMENTIONAL MATCHING OF MECHANICAL SEAL WITH PUMP GA DRAWING.

LEGEND : 1- BHEL OR BHEL NOMINATED THIRD PARTY /END CUSTOMER OF BHEL,
 2- VENDOR,
 3-SUB-VENDOR

P- PERFORM, W- WITNESS, V-VERIFICATION

BHEL	PARTICULARS	BIDDER / VENDOR
	NAME	
	SIGNATURE	
	DATE	

BIDDER/VENDOR SEAL

NAME SIGN. DATE	Prepared By AJAY JAIN 23-07-2012	Reviewed By ASHWANI KHANNA 23-07-2012	Approved By I. J. SINGH 23-07-2012
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**TECHNICAL SPECIFICATIONS****MISCELLANEOUS PUMPS
DATA SHEET - C**SPECIFICATION
NO.:

PE-TS-411-100-N001

VOLUME:

IIB

SECTION:

D1

REV. NO.

0

DATE:

31.07.15

Drawings / documents distribution schedule to be followed by successful bidder :

- 1.0 Drawings/documents submission schedule, shall be as per NIT. The successful bidder shall submit following drawings/ documents.
- 1.1 Fully dimensioned outline general arrangement drawings of the pump and motor assembly. This drawing should include foundation base plate/sole plate details as applicable, civil foundation, anchor bolt details, loading data (Static and Dynamic), points of connections of external piping, cables and mounting of devices furnished by the supplier and details for Gap between Coupling Shafts, Float & details for axial/radial tolerance allowed etc which are required for erecting agency during erection of pump.
- 1.2 Cross sectional drawing of the equipment showing the details of assembly of components and their material of construction with standard applicable codes.
- 1.3 Characteristic curves of pump showing the following:
 - a) Flow Vs Head
 - b) Flow VS Power
 - c) Flow Vs Efficiency
 - d) Flow Vs NPSHR/Min. Submergence
- 1.4 Operation and maintenance manual
- 1.5 Lubrication arrangement drawings for external lubrication (if applicable).
- 2.0 Within the stipulated time period as per vendor's drawings/ documents schedule as per NIT, the O&M Manual comprising of minimum following shall be submitted
 - a) Drawings of components & details as deemed necessary.
 - b) Instruction manual for erection, operation & maintenance.
 - c) Storage instruction.
- 3.0 Before despatch of the equipment the bidder shall furnish the following.
 - a) Material test certificates.
 - b) Shop test reports & certificates.
 - c) Fulfilment of packing instructions as indicated in section C1 of this specification.
- 4.0 Distribution of drawings / documents for all projects:

The no. of drawing/ documents to be submitted by the successful bidder, after the award of the contract shall be intimated after award of contract.

	TECHNICAL SPECIFICATIONS MISCELLANEOUS PUMPS	SPECIFICATION NO.: PE-TS-411-100-N001	
		VOLUME: IIB	SECTION: D2
		REV. NO. 0	DATE: 31.07.15

SECTION D2

STANDARD TECHNICAL SPECIFICATIONS FOR MOTORS

	TITLE	LV MOTORS DATA SHEET-A 4 X 270 MW TSGENCO MANUGURU TPS	SPECIFICATION NO.	
			VOLUME	II B
			SECTION	D
			REV. NO.	DATE 27.07.2015
			SHEET 1	OF 2

1.0	Design ambient temperature	:	50 °C	
2.0	Maximum acceptable kW rating of LV motor	:	160KW *	
3.0	Installation (Indoors/ Outdoors)	:	As required	
4.0	Details of supply system			
	a)	Rated voltage (with variation)	:	415V ± 10%
	b)	Rated frequency (with variation)	:	50 Hz + 3 % to - 5%
	c)	Combined voltage & freq. variation	:	10% (sum of absolute values)
	d)	System fault level at rated voltage	:	50 kA for 1 sec
	e)	Short time rating for terminal boxes		
		o 110 kW and above (Breaker Controlled)	:	50 KA for 0.20 sec..
		o Below 110 kW (Contactor Controlled)	:	50 KA protected by HRC fuse
	f)	LV System grounding	:	Solidly
5.0	Class of insulation	:	Class 'F', with temp rise limited to class B.	
6.0	Minimum voltage for starting (As percentage of rated voltage)	:	(a) 85% below 110KW (b) 80% from 110KW to 160KW (c) 85% above 160KW to 1000KW (d) 80% from 1001 KW to 4000KW (e) 75% > 4000KW	
7.0	Power cables data	:	Shall be given during detailed engg.	
8.0	Earth Conductor Size & Material	:	As per attached Datasheet of Earthing.	
9.0	Space heater supply	:	240 V, 1ϕ, 50 Hz (for motors above 30 Kw)	
10.0	Rating up to which Single phase motor	:	Acceptable below 0.20 kW	
11.0	Locked rotor current			
	a)	Limit as percentage of FLC	:	As per IS 12615*
12.0	Flame-proof motor			
	a)	Enclosure suitable (As per IS: 2148)	:	As per requirement
	b)	Classification of Hazardous area (As per IS: 5572 part-I)	:	As per requirement
13.0	Makes	:	BHEL/ Customer approval	
14.0	Paint shade	:	Shall be given during detailed engg	
15.0	Degree Of protection for motor/ terminal box	:	IP 54/ IP 55	



TITLE

LV MOTORS**DATA SHEET-A****4 X 270 MW TSGENCO MANUGURU TPS**

SPECIFICATION NO.

VOLUME II B

SECTION D

REV NO. DATE 27.07.2015

SHEET 1 OF 2

* Continuous duty LT motors up to 160 KW Output rating (at 50 deg.C ambient temperature), shall be High efficiency IE 3 as per IEC: 60034-30/ IS:12615

16.0 TESTING**16.1 Type Tests**

For LT Motors above 55kW, type test reports for type tests as per IS: 325/ IS: 12615 conducted on equipment similar to those proposed to be supplied and carried out within last five years from the date of bid opening shall be submitted. However, if such reports are not available, one motor of each type shall be subjected to type tests for free of cost.

16.2 Routine Tests

All motors shall be subjected to routine tests as per IS: 325/ IS: 12615 in the presence of customer or customer representative.



TITLE :
GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

SPECIFICATION NO. PE-SS-999-506-E101
VOLUME NO. : II-B
SECTION : D
REV NO. : 00 DATE : 29/08/2005
SHEET : 1 OF 1

GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

SPECIFICATION NO.: PE-SS-999-506-E101 Rev 00

	TITLE : GENERAL TECHNICAL REQUIREMENTS FOR LV MOTORS	SPECIFICATION NO. PE-SS-999-506-E101
		VOLUME NO. : II-B
		SECTION : D
		REV NO. : 00 DATE : 29/08/2005
		SHEET : 1 OF 4

1.0

INTENT OF SPECIFIATION

The specification covers the design, materials, constructional features, manufacture, inspection and testing at manufacturer’s work, and packing of Low voltage (LV) squirrel cage induction motors along with all accessories for driving auxiliaries in thermal power station.

Motors having a voltage rating of below 1000V are referred to as low voltage (LV) motors.

2.0

CODES AND STANDARDS

Motors shall fully comply with latest edition, including all amendments and revision, of following codes and standards:

IS:325	Three phase Induction motors
IS : 900	Code of practice for installation and maintenance of induction motors
IS: 996	Single phase small AC and universal motors
IS: 4722	Rotating Electrical machines
IS: 4691	Degree of Protection provided by enclosures for rotating electrical machines
IS: 4728	Terminal marking and direction of rotation rotating electrical machines
IS: 1231	Dimensions of three phase foot mounted induction motors
IS: 8789	Values of performance characteristics for three phase induction motors
IS: 13555	Guide for selection and application of 3-phase A.C. induction motors for different types of driven equipment
IS: 2148	Flame proof enclosures for electrical appliance
IS: 5571	Guide for selection of electrical equipment for hazardous areas
IS: 12824	Type of duty and classes of rating assigned
IS: 12802	Temperature rise measurement for rotating electrical machnines
IS: 12065	Permissible limits of noise level for rotating electrical machines
IS: 12075	Mechanical vibration of rotating electrical machines

In case of imported motors, motors as per IEC-34 shall also be acceptable.

3.0

DESIGN REQUIREMENTS

3.1

Motors and accessories shall be designed to operate satisfactorily under conditions specified in data sheet-A and Project Information, including voltage & frequency variation of supply system as defined in Data sheet-A

3.2

Motors shall be continuously rated at the design ambient temperature specified in Data Sheet-A and other site conditions specified under Project Information
Motor ratings shall have at least a 15% margin over the continuous maximum demand of the driven equipment, under entire operating range including voltage & frequency variation specified above.

3.3

Starting Requirements

3.3.1

Motor characteristics such as speed, starting torque, break away torque and starting time shall be properly co-ordinated with the requirements of driven equipment. The accelerating torque at any speed with the minimum starting voltage shall be at least 10% higher than that of the driven equipment.

3.3.2

Motors shall be capable of starting and accelerating the load with direct on line starting without exceeding acceptable winding temperature.

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The limiting value of voltage at rated frequency under which a motor will successfully start and accelerate to rated speed with load shall be taken to be a constant value as per Data Sheet - A during the starting period of motors.		
3.3.3 The following frequency of starts shall apply i) Two starts in succession with the motor being initially at a temperature not exceeding the rated load temperature. ii) Three equally spread starts in an hour the motor being initially at a temperature not exceeding the rated load operating temperature. (not to be repeated in the second successive hour) iii) Motors for coal conveyor and coal crusher application shall be suitable for three consecutive hot starts followed by one hour interval with maximum twenty starts per day and shall be suitable for minimum 20,000 starts during the life time of the motor		
3.4 Running Requirements		
3.4.1 Motors shall run satisfactorily at a supply voltage of 75% of rated voltage for 5 minutes with full load without injurious heating to the motor.		
3.4.2 Motor shall not stall due to voltage dip in the system causing momentary drop in voltage upto 70% of the rated voltage for duration of 2 secs.		
3.5 Stress During bus Transfer		
3.5.1 Motors shall withstand the voltage, heavy inrush transient current, mechanical and torque stress developed due to the application of 150% of the rated voltage for at least 1 sec. caused due to vector difference between the motor residual voltage and the incoming supply voltage during occasional auto bus transfer.		
3.5.2 Motor and driven equipment shafts shall be adequately sized to satisfactorily withstand transient torque under above condition.		
3.6 Maximum noise level measured at distance of 1.0 metres from the outline of motor shall not exceed the values specified in IS 12065.		
3.7 The max. vibration velocity or double amplitude of motors vibration as measured at motor bearings shall be within the limits specified in IS: 12075.		
4.0 CONSTRUCTIONAL FEATURES		
4.1 Indoor motors shall conform to degree of protection IP: 54 as per IS: 4691. Outdoor or semi-indoor motors shall conform to degree of protection IP: 55 as per IS: 4691 and shall be of weather-proof construction. Outdoor motors shall be installed under a suitable canopy		
4.2 Motors upto 160KW shall have Totally Enclosed Fan Cooled (TEFC) enclosures, the method of cooling conforming to IC-0141 or IC-0151 of IS: 6362. Motors rated above 160 KW shall be Closed Air Circuit Air (CACA) cooled		
4.3 Motors shall be designed with cooling fans suitable for both directions of rotation.		

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4.4.	Motors shall not be provided with any electric or pneumatic operated external fan for cooling the motors.	
4.5	Frames shall be designed to avoid collection of moisture and all enclosures shall be provided with facility for drainage at the lowest point.	
4.6	In case Class 'F' insulation is provided for LV motors, temperature rise shall be limited to the limits applicable to Class 'B' insulation. In case of continuous operation at extreme voltage limits the temperature limits specified in table-1 of IS:325 shall not exceed by more than 10°C.	
4.7	Terminals and Terminal Boxes	
4.7.1	Terminals, terminal leads, terminal boxes, windings tails and associated equipment shall be suitable for connection to a supply system having a short circuit level, specified in the Data Sheet-A. Unless otherwise stated in Data Sheet-A, motors of rating 110 kW and above will be controlled by circuit breaker and below 110 kW by switch fuse-contactor. The terminal box of motors shall be designed for the fault current mentioned in data sheet "A".	
4.7.2	unless otherwise specified or approved, phase terminal boxes of horizontal motors shall be positioned on the left hand side of the motor when viewed from the non-driving end.	
4.7.3	Connections shall be such that when the supply leads R, Y & B are connected to motor terminals A B & C or U, V & W respectively, motor shall rotate in an anticlockwise direction when viewed from the non-driving end. Where such motors require clockwise rotation, the supply leads R, Y, B will be connected to motor terminals A, C, B or U W & V respectively.	
4.7.4	Permanently attached diagram and instruction plate made preferably of stainless steel shall be mounted inside terminal box cover giving the connection diagram for the desired direction of rotation and reverse rotation.	
4.7.5	Motor terminals and terminal leads shall be fully insulated with no bar live parts. Adequate space shall be available inside the terminal box so that no difficulty is encountered for terminating the cable specified in Data Sheet-A.	
4.7.6	Degree of protection for terminal boxes shall be IP 55 as per IS 4691.	
4.7.7	Separate terminal boxes shall be provided for space heaters.. If this is not possible in case of LV motors, the space heater terminals shall be adequately segregated from the main terminals in the main terminal box. Detachable gland plates with double compression brass glands shall be provided in terminal boxes.	
4.7.8.	Phase terminal boxes shall be suitable for 360 degree of rotation in steps of 90 degree for LV motors.	
4.7.9	Cable glands and cable lugs as per cable sizes specified in Data Sheet-A shall be included. Cable lugs shall be of tinned Copper, crimping type.	
4.8	Two separate earthing terminals suitable for connecting G.I. or MS strip grounding conductor of size given in Data Sheet-A shall be provided on opposite sides of motor frame. Each terminal box shall have a grounding terminal.	
4.9	General	

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4.9.1 Motors provided for similar drives shall be interchangeable. 4.9.2 Suitable foundation bolts are to be supplied alongwith the motors. 4.9.3 Motors shall be provided with eye bolts, or other means to facilitate safe lifting if the weight is 20Kgs. and above. 4.9.4 Necessary fitments and accessories shall be provided on motors in accordance with the latest Indian Electricity rules 1956. 4.9.5 All motors rated above 30 kW shall be provided with space heaters to maintain the motor internal air temperature above the dew point. Unless otherwise specified, space heaters shall be suitable for a supply of 240V AC, single phase, 50 Hz. 4.9.6 Name plate with all particulars as per IS: 325 shall be provided 4.9.7 Unless otherwise specified, the colour of finish shall be grey to Shade No. 631 and 632 as per IS:5 for motors installed indoor and outdoor respectively. The paint shall be epoxy based and shall be suitable for withstanding specified site conditions. 5.0 INSPECTION AND TESTING 5.1 All materials, components and equipments covered under this specification shall be procured, manufactured, as per the BHEL standard quality plan No. PED-506-00-Q-006/0 and PED-506-00-Q-007/2 enclosed with this specification and which shall be complied. 5.2 LV motors of type-tested design shall be provided. Valid type test reports not more than 5 year shall be furnished. In the absence of these, type tests shall have to be conducted by manufacturer without any commercial implication to purchaser. 5.3 All motors shall be subjected to routine tests as per IS: 325 and as per BHEL standard quality plan. 5.4 Motors shall also be subjected to additional tests, if any, as mentioned in Data Sheet A. 6.0 DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT a) OGA drawing showing the position of terminal boxes, earthing connections etc. b) Arrangement drawing of terminal boxes. c) Characteristic curves: (To be given for motor above 55 kW unless otherwise specified in Data Sheet). i) Current vs. time at rated voltage and minimum starting voltage. ii) Speed vs. time at rated voltage and minimum starting voltage. iii) Torque vs. speed at rated voltage and minimum voltage. For the motors with solid coupling the above curves i), ii), iii) to be furnished for the motors coupled with driven equipment. In case motor is coupled with mechanical equipment by fluid coupling, the above curves shall be furnished with and without coupling. iv) Thermal withstand curve under hot and cold conditions at rated voltage and max. permissible voltage.		

	TECHNICAL SPECIFICATIONS	SPECIFICATION NO.:	PE-TS-411-100-N001	
	MISCELLANEOUS PUMPS	VOLUME:	IIB	SECTION: D2
		REV. NO.	0	DATE: 31.07.15

SECTION D2

STANDARD QUALTY PLAN FOR MOTORS

		QUALITY PLAN		CUSTOMER :		PROJECT TITLE		SPECIFICATION : NUMBER :				
				BIDDER/ VENDOR :		QUALITY PLAN NUMBER PED-506-00-Q-007/2		SPECIFICATION : TITLE				
		SHEET 1 OF 9		SYSTEM		ITEM: AC ELECT. MOTORS 75KW & ABOVE (LV & MV)		SECTION		VOLUME III		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	P	W	V	
1.0	RAW MATERIAL & BROUGHT CONTROL											
1.1	SHEET STEEL, PLATES, SECTION, EYEBOLTS	1.SURFACE CONDITION	MA	VISUAL	100%	-	FREE FROM BLINKS, CRACKS, WAVINESS ETC	LOG BOOK	3	-	-	PROPERTY CLASS MARKING SHALL BE CHECKED BY THE VENDOR
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	-DO-	3	-	-	
		3.PROOF LOAD TEST (EYE BOLT)	MA	MECH. TEST	-DO-	-DO-	-DO-	INSPEC. REPORT	3	-	-	
1.2	HARDWARES	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, UN-EVENNESS ETC.	-DO-	3	-	-	
		2.PROPERTY CLASS	MA	VISUAL	SAMPLES	MANFR'S DRG./SPEC BOOK	RELEVANT IS/SPEC.	SUPPLIERS TC & LOG	3	-	2	
1.3	CASTING	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, BLOW HOLES ETC.	LOG BOOK	3	-	-	
		2.CHEM. & PHY. PROP.	MA	CHEM & MECH TEST	1/HEAT NO.	MANFR'S DRG./SPEC	RELEVANT IS/	SUPPLIER'S TC	3	-	2	HEAT NO. SHALL BE VERIFIED
		3.DIMENSIONS	MA	MEASUREMENT	100%	MANUFR'S DRG.	MANUFR'S DRG.	LOG BOOK	3	-	-	
1.4	PAINT & VARNISH	1.MAKE, SHADE, SHELF LIFE & TYPE	MA	VISUAL	100% CONTINUOUS	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	LOG BOOK	3	-	-	
BHEL			PARTICULARS		BIDDER/VENDOR							
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN		CUSTOMER :		PROJECT TITLE		SPECIFICATION : NUMBER :				
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007/2		SPECIFICATION : TITLE				
		SHEET 2 OF 9		SYSTEM		ITEM: AC ELECT. MOTORS 75KW & ABOVE (LV & MV)		SECTION		VOLUME III		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
1.5	SHAFT (FORGED OR ROLLED)	1. SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED
		2. CHEM. & PHYSICAL PROPERTIES	MA	CHEM. & PHYSICAL TESTS	1/HEAT NO. OR HEAT TREATMENT BATCH NO	MFG. DRG. SPEC.	RELEVANT IS	SUPPLIER'S TC	3	-	2	
		3. DIMENSIONS	MA	MEASUREMENT	100%	-DO-	MANUFR'S DRG.	LOG BOOK	3	-	-	
		4.INTERNAL FLOWS	CR	UT	-DO-	ASTM-A388	MANUFR'S SPEC. BHEL SPEC.	-DO-	3	2	1	
1.6	SPACE HEATERS, CONNEC-TORS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTD'S	1. MAKE & RATING	MA	VISUAL	-DO-	MANUFR'S DRG. SPEC.	MANUFR'S DRG. SPEC.	-DO-	3	-	-	FOR DIA OF 55 MM & ABOVE
		2. PHYSICAL COND.	MA	-DO-	-DO-	-	NO BREAKAGE ON OTHER PHY. DESIGN	-DO-	3	-	-	
		3.DIMENSIONS (WHEREVER APPLICABLE)	MA	MEASUREMENT	SAMPLE	MANUFR'S DRG./ SPEC.	MANUFR'S DRG. / SPEC.	-DO-	3	-	-	
		4.PERFORMANCE/ CALIBRATION	MA	TEST	100%	-DO-	-DO-	INSP. REPORT	3	-	-	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :		
				BIDDER/ VENDOR			QUALITY PLAN NUMBER PED-506-00-Q-007/2			SPECIFICATION : TITLE		
		SHEET 3 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 75KW & ABOVE (LV & MV)			SECTION		VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	P	W	V	11
1.7	OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC.	1. SURFACE COND.	MA	VISUAL	100%	-	NO VISUAL DEFECTS	INSPT. REPORT	3	-	-	FOR MV MOTOR INSULATION/VARNISH THICKNESS SHALL BE MORE THAN THE BURS HEIGHT
		2. OTHER CHARACTERISTICS	MA	TEST	SAMPLE	MANUF'S SPEC.	MANUF'S SPEC.	LOG BOOK AND OR SUPPLIER'S TC	3	-	2	
1.8	SHEET STAMPING (PUNCHED)	1. SURFACE COND.	MA	VISUAL	100%	-	NO VISUAL DEFECTS (FREE FROM BURS)	LOG BOOK	3	-	-	
		2.DIMENSIONS INCLUDING BURS HEIGHT	MA	MEASUREMENT	SAMPLE	MANUFR'S DRG. .	MANUFR'S DRG.	-DO-	3	-	2	
		3. ACCEPTANCE TESTS	MA	ELECT. & MECH TESTS	-DO-	MANUF'S SPEC./ RELEVANT IS	RELEVANT IS	SUPPLIER'S TC	3	-	2	
1.9	CONDUCTORS	1. SURFACE FINISH	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	LOG BOOK	3	-	-	
		2.ELECT. PROP. & MECH. PROP	MA	ELECT. & MECH.TEST	SAMPLES	RELEVANT IS/ BS OR OTHER STANDARDS	RELEVANT IS/ BS OR OTHER STANDARDS	SUPPLIERS TC & VENDOR'S INSPN. REPORTS	3/2	-	2	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE									
									BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN		CUSTOMER :		PROJECT TITLE			SPECIFICATION : NUMBER :				
				BIDDER/ VENDOR :		QUALITY PLAN NUMBER PED-506-00-Q-007/2			SPECIFICATION : TITLE				
		SHEET 4 OF 9		SYSTEM		ITEM: AC ELECT. MOTORS 75KW & ABOVE (LV & MV)			SECTION		VOLUME III		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS	
1	2	3	4	5	6	7	8	9	10	P	W	V	11
1.10	BEARINGS	3.DIMENSIONS	MA	MEASUREMENT	-DO-	-DO-	-DO-	Log Book	3	-	-		
		1.MAKE & TYPE	MA	VISUAL	100%	MANFR'S DRG.	MANFR'S DRG.	-DO-	3	-	-		
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	BHEL DATA SHEET	BHEL DATA SHEET BEARING MANUF'S CATALOGUES	-DO-	3	-	-		
1.11	SLIP RING	3.SURFACE FINISH	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-		
		1.SURFACE COND.	MA	VISUAL	100%	-	-DO-	-DO-	3	-	-		
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-		
		3.TEMP.WITH-STAND CAPACITY	MA	ELECT.TEST	-DO-	MANUF'S SPEC.	MANUF'S SPEC.	-DO-	3	-	-		
1.12	OIL SEALS & GASKETS	4.HV/IR	MA	-DO-	100%	-DO-	-DO-	-DO-	3	-	-		
		1.MATERIAL OF GASKET	MA	VISUAL	100%	MANUF'S DRG/SPECS	MANUF'S DRG./ SPECS.	-DO-	3	-	-		
		2.SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-		
		3.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-		
BHEL			PARTICULARS		BIDDER/VENDOR								
			NAME										
			SIGNATURE										
			DATE										
												BIDDER'S/VENDORS COMPANY SEAL	

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		SHEET 5 OF 9		SYSTEM		ITEM: AC ELECT. MOTORS 75KW & ABOVE (LV & MV)			SECTION		VOLUME III	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	P	W	V	11
2.0	IN PROCESS											
2.1	STATOR FRAME WELDING (IN CASE OF FABRICATED STATOR)	1.WORKMANSHIP & CLEANNES	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	
2.2	MACHINING	1.FINISH	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	
		3.SHAFT SURFACE FLOWS	MA	PT	-DO-	RELEVANT SPEC./ ASTM-E165	MANUF'S SPEC./ BHEL SPEC./	-DO-	3	-	1	
2.3	PAINTING	1.SURFACE PREPARATION	MA	VISUAL	100%	MANFR'S SPEC/BHEL SPEC./ RELEVANT STAND	BHEL SPEC. SAME AS COL.7	LOG BOOK	3	-	-	
		2.PAINT THICKNESS (BOTH PRIMER & FINISH COAT)	MA	MEASUREMENT BY ELCOMETER	SAMPLE	-DO-	-DO-	-DO-	3	-	2	
		3.SHADE	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	3	-	-	
		4.ADHESION	MA	CROSS CUTTING & TAPE TEST	-DO-	-DO-	-DO-	Log Book	3	-	-	
BHEL			PARTICULARS		BIDDER/VENDOR							
			NAME									
			SIGNATURE									
			DATE					BIDDER'S/VENDORS COMPANY SEAL				

		QUALITY PLAN		CUSTOMER :		PROJECT TITLE			SPECIFICATION : NUMBER :			
				BIDDER/ VENDOR :		QUALITY PLAN NUMBER PED-506-00-Q-007/2			SPECIFICATION : TITLE			
		SHEET 6 OF 9		SYSTEM		ITEM: AC ELECT. MOTORS 75KW & ABOVE (LV & MV)			SECTION		VOLUME III	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	P	W	V	11
2.4	SHEET STACKING	1.COMPLETENESS	MA	MEASUREMENT	SAMPLE	MANUFR'S SPEC.	MANUFR'S SPEC.	Log Book	3	-	-	(FOR MOTORS OF 2MW AND ABOVE)
		2.COMPRESSION & TIGHTENING	MA	MEASUREMENT	100%	-DO-	-DO-	Log Book	3	-	-	
		3.CORE LOSS & HOTOPOT	MA	ELECT.TEST	-DO-	-DO-	-DO-	Log Book	3	-	2	
2.5	WINDING	1.COMPLETENESS	CR	VISUAL	100%	MANUFR'S SPEC./BHEL SPEC.	MANUFR'S SPEC./BHEL SPEC.	Log Book	3	-	-	FOR MV MOTOR
		2.CLEANLINESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	3	-	-	
		3.IR-HV-IR	CR	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	3	-	-	
		4.RESISTANCE	CR	-DO-	-DO-	-DO-	-DO-	Log Book	3	-	2	
		5.INTERTURN INSULATION	CR	-DO-	-DO-	-DO-	-DO-	Log Book	3	2	-	
		6.SURGE WITH STAND AND TAN. DELTA TEST	CR	-DO-	-DO-	-DO-	-DO-	Log Book	3	2	1	
2.6	IMPREGNATION	1.VISCOSCITY	MA	PHY. TEST	AT STARTING	-DO-	-DO-	Log Book	3	-	-	THREE DIPS TO BE GIVEN
		2.TEMP. PRESSURE VACCUM	MA	PROCESS CHECK	CONTINUOUS	-DO-	-DO-	Log Book	3	-	-	
		3.NO. OF DIPS	MA	-DO-	-DO-	-DO-	-DO-	Log Book	3	-	2	
BHEL			PARTICULARS		BIDDER/VENDOR							
			NAME									
			SIGNATURE									
			DATE					BIDDER'S/VENDORS COMPANY SEAL				

		QUALITY PLAN		CUSTOMER :		PROJECT TITLE			SPECIFICATION : NUMBER :			
				BIDDER/ VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007/2			SPECIFICATION : TITLE			
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SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
2.7	COMPLETE STATOR ASSEMBLY	4.DURATION	MA	-DO-	-DO-	-DO-	-DO-	Log Book	3	-	2	VERIFICATION FOR MV MOTOR ONLY
		1.COMPACTNESS & CLEANLINESS	MA	VISUAL	100%	-DO-	-DO-	Log Book	3	-	-	
2.8	BRAZING/COMPRESSION JOINT	1.COMPLETENESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	3	-	-	
		2.SOUNDNESS	CR	MALLET TEST & MV TEST	-DO-	-DO-	-DO-	Log Book	3	-	-	
		3.HV	MA	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	3	-	-	
2.9	COMPLETE ROTOR ASSEMBLY	1.RESIDUAL UNBALANCE	CR	DYN. BALANCE	-DO-	MFG SPEC./ ISO 1940	MFG. DWG.	Log Book	3	2	1	
		2.SOUNDNESS OF DIE CASTING	CR	ELECT. (GROWLER TEST)	-DO-	MFG. SPEC.	MFG. SPEC.	Log Book	3	2	-	
2.10	ASSEMBLY	1.ALIGNMENT	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	3	-	-	
		2.WORKMANSHIP	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	3	-	-	
		3.AXIAL PLAY	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	3	-	2	
		4.DIMENSIONS	MA	-DO-	-DO-	MFG.DRG./ MFG SPEC.	MFG. DRG/ RELEVANT IS	Log Book	3	-	-	
		5.CORRECTNESS, COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE	MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	3	-	-	
BHEL			PARTICULARS		BIDDER/VENDOR							
			NAME									
			SIGNATURE									
			DATE									
									BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN		CUSTOMER :		PROJECT TITLE			SPECIFICATION : NUMBER :			
				BIDDER/ VENDOR :		QUALITY PLAN NUMBER PED-506-00-Q-007/2			SPECIFICATION : TITLE			
		SHEET 8 OF 9		SYSTEM		ITEM: AC ELECT. MOTORS 75KW & ABOVE (LV & MV)			SECTION		VOLUME III	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	P	W	V	11
3.0	TESTS	1.TYPE TESTS INCLUDING SPECIAL TESTS AS PER BHEL SPEC.	MA	ELECT.TEST	1/TYPE/SIZE	IS-325/ BHEL SPEC./ DATA SHEET	IS-325/ BHEL SPEC./ DATA SHEET	TEST REPORT	3	1	1,2	NOTE - 1
		2.ROUTINE TESTS INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	-DO-	-DO-	-DO-	3	1,2	1,2	NOTE - 2
		3.VIBRATION	MA	-DO-	100%	IS-12075	IS-12075	-DO-	3	1,2	-	
		4.OVERALL DIMENSIONS AND ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPC. REPORT	3	2,1	-	
		5.DEGREE OF PROTECTION	MA	ELECT. & MECH. TEST	1/TYPE/ SIZE	RELEVANT IS	BHEL SPEC. AND DATA SHEET	TC	3	-	2,1	TC FROM AN INDEPENDENT LABORATORY NOTE-3
		6.NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPC. REPORT	3	2,1	-	
		7.EXPLOSION FLAME PROOF NESS (IF SPECIFIED)	MA	EXPLOSION FLAME PROOF TEST	1/TYPE	IS-3682 IS-8239 IS-8240	IS-3682 IS-8239 IS-8240	TC	3	-	2,1	NOTE-3
		8.PAINT SHADE, THICKNESS & FINISH	MA	VISUAL & MEASUREMENT BY ELKOMETER	SAMPLE	BHEL SPEC. & DATA SHEET	BHEL SPEC. & DATA SHEET	TC	3	2,1	-	SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY
BHEL			PARTICULARS		BIDDER/VENDOR							
			NAME									
			SIGNATURE									
			DATE					BIDDER'S/VENDORS COMPANY SEAL				

		QUALITY PLAN SHEET 9 OF 9		CUSTOMER :		PROJECT TITLE			SPECIFICATION : NUMBER :			
				BIDDER/ VENDOR :		QUALITY PLAN NUMBER PED-506-00-Q-007/2			SPECIFICATION : TITLE			
				SYSTEM		ITEM: AC ELECT. MOTORS 75KW & ABOVE (LV & MV)			SECTION		VOLUME III	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
NOTES: 1 DEPENDING UPON THE SIZE AND CRITICALLY, WITNESSING BY BHEL SHALL BE DECIDED. 2 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON. 3 IN CASE TEST CERTIFICATES FOR THESE TESTS ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR FROM INDEPENDENT LABORATORY ARE AVAILABLE, THESE TEST MAY NOT BE REPEATED. 4 WHEREVER CUSTOMER IS INVOLVED IN INSPECTION WITH THE CUSTOMERS, AGENCY (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.												
BHEL			PARTICULARS		BIDDER/VENDOR							
			NAME									
			SIGNATURE									
			DATE									
											BIDDER'S/VENDORS COMPANY SEAL	

		QUALITY PLAN		CUSTOMER :			PROJECT		SPECIFICATION :			
				BIDDER/ :			TITLE		NUMBER :			
		SHEET 1 OF 2		VENDOR			QUALITY PLAN		NUMBER PED-506-00-Q-006/0		SPECIFICATION	
		SYSTEM			ITEM AC ELECT. MOTORS BELOW 75KW (LV)				SECTION VOLUME III			
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
1.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	MANUFR'S SPEC/BHEL SPEC./RELEVANT STANDARD	BHEL SPEC. SAME AS COL.7	LOG BOOK	3	-	-	
2.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	MANUF'S SPEC	MANUF'S SPEC	-DO-	3	-	-	
		2.DIMENSIONS	MA	-DO-	-DO-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	-DO-	3	-	-	
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/COLOUR CODE	MA	VISUAL	100%	MFG.SPEC./ RELEVANT IS	MFG.SPEC. RELEVANT IS	-DO-	3	-	-	
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	IS-325/ BHEL SPEC./ DATA SHEET	SAME AS COL.7	TEST REPORT	3	2,1	2,1	
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPN. REPORT	2	1	-	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE									
									BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :		
				BIDDER/ : VENDOR			QUALITY PLAN NUMBER PED-506-00-Q-006/0			SPECIFICATION : TITLE :		
		SHEET 2 OF 2		SYSTEM			ITEM AC ELECT. MOTORS BELOW 75KW (LV)			SECTION		VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
	NOTES:	3.NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPN. REPORT	3	1	-	
	1	ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON										
	2	WHERE EVER CUSTOMER IS INVOLVED IN INSPECTION, (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.										
	3	FOR EXHAUST/VENTILATION FAN MOTORS OF RATING UPTO 1.5KW , ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY.										
BHEL			PARTICULARS			BIDDER/VENDOR			BIDDER'S/VENDORS COMPANY SEAL			
			NAME									
			SIGNATURE									
			DATE									